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Garvin
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★Engineering News

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ILLUSTRATED CATALOGUE

OF

The Garvin Machine Co.,

SPRING AND VARICK STREETS,

NEW YORK CITY.

PHILADELPHIA STORE :

The Garvin Machine Co.,
51 No. 7th Street, Philadelphia, Pa.

BERLIN :

Deutsche Garvin Maschinen Fabrik A. G.
17 Burg Strasse, Berlin, C., Germany.

MACHINE TOOLS,

INCLUDING

UNIVERSAL AND PLAIN MILLING MACHINES,

*Screw Machines,
Monitor Lathes,
Hand Lathes,
Chucking Lathes,
Tapping Machines,*

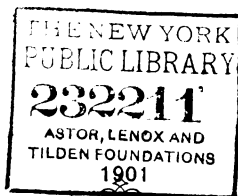
*Drill Presses,
Cutter Grinders,
Forming Machines,
Gear Cutters,
Profilers, Etc.*

Special Labor-saving Machines

For Bicycle and Automobile Construction.

PRICES UPON APPLICATION.

MARCH, 1900.



SPECIAL NOTICE.

You are kindly requested to peruse the specification of New Tools and Machines on pages 34, 36, 38, 42, 43, 44, 90, 92, 95 to 105, 112, 117, 119, 121, 122, 132, and 133.

Many of the machines shown on pages not mentioned above have been rebuilt from entirely new patterns and a careful study of all the machines will show many new designs and improvements.

We design and build to order special and automatic machinery for reducing cost of labor and increasing production.



NOT FOR
CIRCULATION
PUBLISHED

INTRODUCTION.

The business now conducted by this firm was established in 1862 and incorporated in 1889.

Our equipment throughout, both large and small tools, being entirely modern, our facilities for construction are unexcelled, and we can give our customers the protection of an absolutely Fireproof Building, securing them against loss or delay in the execution of their orders.

The highest standard of excellence and efficiency of our product is maintained by a rigid system of inspection of every part during successive stages of manufacture.

We do not use the piecework or contract system, but we do use the very best materials and skill obtainable, and with the aid of special machinery and fixtures are enabled to supply duplicate parts of our tools at a nominal cost.

This edition of our catalogue contains many new and improved machines.

Our shipping facilities are such that we can secure for our customers the best freight rates and the most direct shipments.

TERMS: Cash in thirty days to responsible parties, unless otherwise agreed.

PRICES: F. O. B. New York. Boxing at cost for export.

FOREIGN ORDERS should always be accompanied by instructions to bankers here to pay our bill on presentation of shipping documents.

For convenience of our patrons in communicating with us by telegraph, we have inserted a cipher word in connection with each machine or tool, and also appended a code for general questions (see page 150). In addition to the above we use Lieber's and A. B. C. codes when required.

Respectfully yours.

G. K. GARVIN, *Pres.*

F. W. GARVIN, *Secy.*

E. E. GARVIN, *Treas.*

THE GARVIN MACHINE CO.

General Specification of our Universal Milling Machines.

The design and construction of our Universal Milling Machines are the result of over thirty-five years' experience in jobbing and manufacturing and a careful study of the requirements of the trade. They embody several new and valuable features.

The **column or frame** is well proportioned, with large bearing surfaces and ample strength around the spindle and arm.

The overhanging telescope arm is large and well supported, and provided with stout braces, is clamped front and back, and can be swung around or instantly removed. The outer end of the arm carries our improved cylindrical outboard bearing, made of tool steel, hardened and ground, which affords ample support and bearing surface for the cutter arbor. This form of bearing allows for the expansion of the arbor, while holding it perfectly firm.

The **spindle** is very large in all cases, and the bearings are of the design shown on the opposite page. The combination of the steel spindle and bronze box produces a bearing unexcelled for standing heavy cutting stresses, while the form and means of lubrication assure the most efficient service.

The arbor is drawn into and removed from its seat by a screw rod reaching through the spindle.

Two countershaft speeds are given, but for general tool work we recommend open and crossed belts.

The **table** is wide and deep, with a bearing of more than half its length in the swivel block. The adjustments, lengthways, sideways, and vertical, are to thousandths of an inch. The table can be swiveled on a graduated base to 45 degrees either way from the straight position, and firmly bound by bolts at each end of the swivel block. The knee has a long and wide bearing on the column, affords a large range of in and out adjustment, and is specially ribbed and stiffened to prevent spring and vibration.

The feed mechanism is reversible while running by lever at the front, operates and trips automatically at all angles and in either direction, and is tripped and started by the same handle.

In the No. 1 and No. 2 Millers twelve feed changes are provided by cone pulleys and change gears, and in the No. 2 in and out power feed, with reverse and automatic trip, is provided.

General Specification of our Universal Milling Machines.

(Continued.)

In the No. 3 and larger sizes our patented system is introduced whereby 18 *changes* are provided, ranging from .003 to $\frac{1}{4}$ of an inch, and any desired feed is obtained instantly by simply turning a handle round to the corresponding number on an index disk. In the No. 3 and larger sizes power feed is provided in all directions, and all these feeds are stopped, started, or reversed by the same handle, at the front, and subject to the same number of changes.

The **feed cone brackets** are arranged to swivel on a round base to tighten the belt, and are fitted with straining screw.

All **elevating screws** are provided with ball thrusts, which greatly increases the sensitiveness and ease of handling of the machine.

The elevating screw in the large sizes does not pass through the floor, which is a great advantage in fireproof buildings.

The **dividing head** has an extended base and two holding-down bolts, insuring great solidity. The spindle has a large hole through it, and the taper end of the hole is the same as that in the main spindle, allowing an interchange of tools. An Universal three-jawed chuck is fitted and the dividing worm gear is provided with our patent compensating wedge, which permits of instant adjustment for any slack in the gear.

Three index plates are provided, giving all divisions up to 50 and, excepting a few prime numbers, nearly all up to 360. The gearing for spiral cutting is arranged for compound trains, and designed to give a large number of spirals of even pitch, as one turn in $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3 inches, etc.

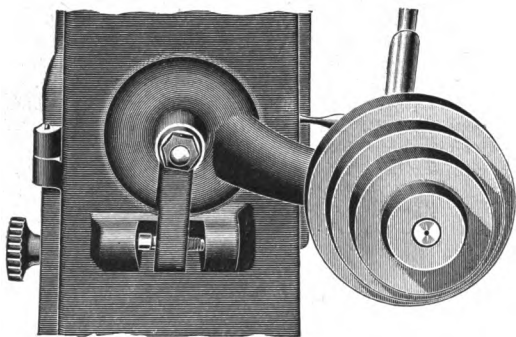
On the large dividing heads a large dial is fitted direct on the spindle for quick indexing of squares, hexagons, and other small divisions, and arrangement is made for withdrawing the worm shaft when using this dial.

An extension plate is provided, so that the head may be set at any angle or in line with the main spindle.

The **tail stock** is solid and substantial, and permits of working close to the line of centers, and the spindle is bound its whole length without throwing out of line.

The **swivel vise** is well protected and solidly mounted on a graduated base, and can be set at any angle in either the horizontal or vertical position.

The **index table** is printed directly on wood, making it practically indestructible.



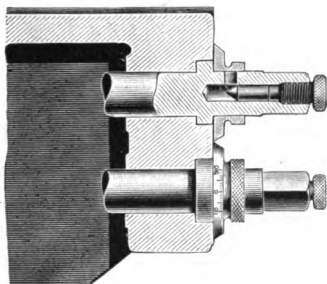
Patent Pending.

Feed Cone Bracket.

This is the standard form of feed pulley bracket as used on our milling machines.

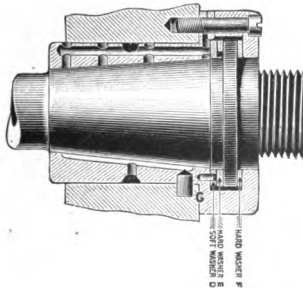
The bracket is held on a round base by a central bolt and swivels to take up the belt. The lug on the bracket sets between two lugs on the column, and the set screw serves to strain up the belt and hold it.

The pulley is overhung so that the belt can be removed at once. and runs on a hollow stud through which the pulley shaft passes. The shaft is relieved of the pull of the belt, and any undue wear of the bearing is avoided.



Standard Micrometer Milling Machine Adjustment.

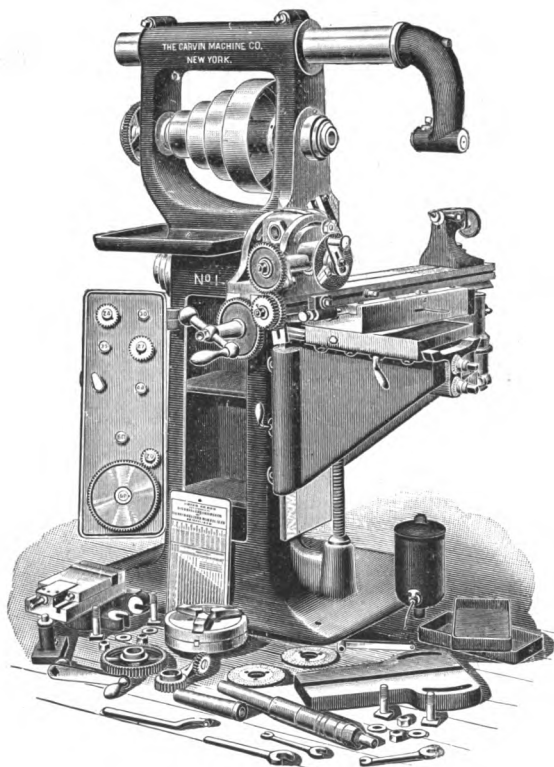
On the shafts controlling the in and out and the vertical adjustments of the knees, and on the table feed screws of the Universal Milling Machines, are fitted beveled steel collars, graduated to indicate thousandths of an inch. These collars are readily set by means of the knurling, and are bound in position by means of the knurled head screw at the end of the shaft. This screw is small enough not to interfere with the free use of the crank wrench. This design of indicator has the advantage of giving all readings at the top in plain sight, and combines in itself the means of rapid setting and binding.



Standard Spindle Bearing.

This cut shows our standard form of spindle and bearing as used in our milling machines. The spindle has a taper of 5 degrees, and the thrust is taken in either direction by a hardened and ground washer on each side of the collar of the spindle. A soft packing washer is provided that may be taken out and faced off in the lathe to let the spindle in further to take up wear. A large cap holds the spindle back to its seat and thoroughly protects the bearing from dirt.

The taper form of the spindle wears back in its seat, thereby maintaining a perfect bearing and preserving its alignment. The rear bearing is straight with an external taper box. The arrangements for self-oiling are thoroughly effective. A deep hole in the body of the box and a groove on the outside serves as an oil reservoir, and oil holes and channels lead the oil to the spindle on all sides and also to the thrust washers.



No. 1 Universal Milling Machine.

Patent Pending.

Specification of No. 1 Universal Milling Machine.

This is the machine most commonly used for general toolroom work in machine tool shops, and in the manufacture of bicycles, horseless carriages, electrical goods, etc.

All details of construction are of substantial size, best workmanship, and easily accessible, and the machine embodies all our standard features of arm and braces, outboard center, spindle bearing, draw-in rod for arbor, micrometer adjustments, ball thrust in elevating screw, belt tightener, feed pulley bracket, etc.

The table feed is thrown in and tripped by a small lever in front and the feed can be reversed while running, by turning a small knob at the side. The table feed screw is provided with a micrometer dial, which is convenient for spacing work.

Changes of feed are provided by cone pulleys and change gears.

A long bearing is provided for the table in the swivel block, which secures the maintenance of the alignment and prevents undue wear.

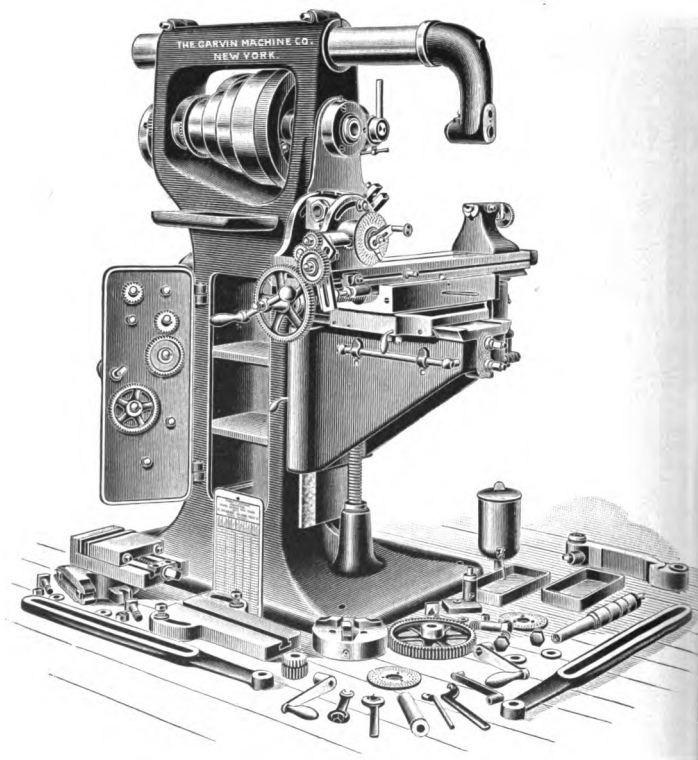
The base of the swivel vise is arranged to set horizontally or vertically, and in either position the vise can be quickly set to any angle on the graduated base.

The dividing worm gear of the dividing head is accurate, and is fitted with our patent wedge adjustment for wear.

For general description, see page 6.

Dimensions of table.....	5½ x 31¼ in.
Vertical adjustment under spindle.....	18½ in.
Adjustment in line with spindle.....	7½ in.
Length of automatic feed of table.....	17 in.
Length of hand feed of table.....	22 in.
Greatest distance from end of spindle to outboard bearing...	12½ in.
Swing under arm.....	12½ in.
Front spindle bearing.....	2 13-16x4½ in.
Arbor hole in spindle, B. & S. taper.....	No. 10
Largest diameter of cone.....	11¾ in.
Change of speed by cone 4, increased by countershaft to.....	8
Width of belt required.....	3 in.
Number of feed changes.....	12
Bearing of table in swivel block.....	15 in.
Swing of centers.....	10 in.
Distance between centers.....	15½ in.
Diameter of hole through dividing head.....	1 1-16 in.
Size of vise furnished.....	No. 3
Friction pulleys on countershaft.....	14 in. x 3 in.
Speed of countershaft; revolutions per minute.....	80-100
Floor space required.....	60 in. x 52 in.
Domestic shipment, crated, weight.....	1,725 lbs.
Foreign shipment, tight boxed (45 c. f.).....	2,050 lbs.
Code word, complete as shown.....	(Abide)

For tools and attachments, see pages 62 to 66.



No. 2 Universal Milling Machine.

Patent Pending.

Specification of No. 2 Universal Milling Machine.

This size of Universal Miller is capable of taking a heavier cut and is adapted to a wider range of tool and general machine work than the No. 1, yet meets the requirements for convenience and easy manipulation which has made the No. 1 so popular.

The spindle is driven by a four-step cone back geared six to one, and the general range of the machine makes it particularly adapted for general use.

In this machine, in and out power feed, with reverse and automatic trip is provided, and the feed is thrown in, tripped and reversed by the same small lever and knob used for the slide, and has the same changes. The table has three T slots, and the feed screw is provided with a micrometer dial, which is a most convenient adjunct to the in and out power feed. Changes of feed are provided by cone pulleys and change gears.

The dividing head is accurate, and has an extended base with two bolts, which prevent any tendency to lift and chatter.

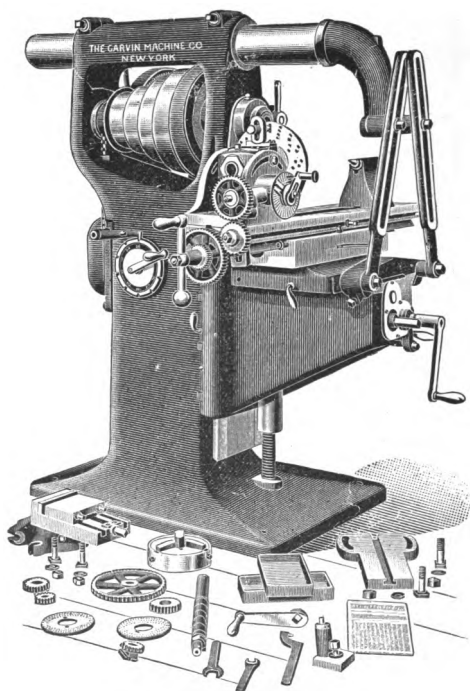
The swivel block provides a long bearing for the slide and is solidly bound by a bolt at each end.

All our standard features, arm and braces, outboard bearing, spindle bearing, draw-in rod for arbor, micrometer adjustments, belt tightener, feed pulley bracket, ball thrust on elevating screw, etc., are incorporated in this machine.

For general description, see page 6.

Dimensions of table inside oil pockets.....	7½x36 in.
Vertical adjustment under spindle.....	20¾ in.
Adjustment in line with spindle.....	8 in.
Length of automatic feed of table.....	25½ in.
Length of hand feed of table.....	30 in.
Greatest distance from end of spindle to outboard bearing....	16 in.
Swing under arm.....	12½ in.
Front spindle bearing.....	3x4¾ in.
Arbor hole in spindle, B. & S. taper.....	No. 10
Largest diameter of cone.....	11¾ in.
Change of speed by cone and back gears, 8, increased by countershaft to.....	16
Width of belt required.....	3 in.
Number of feed changes.....	12
Bearing of table in swivel block.....	19 in.
Swing of centers.....	10¼ in.
Distance between centers.....	19 in.
Diameter of hole through dividing head.....	1 1-16 in.
Size of vise furnished.....	No 4
Friction pulleys on countershaft.....	14x4 in.
Speed of countershaft, revolutions per minute.....	110-150
Floor space required.....	74x69 in.
Domestic shipment, crated, weight.....	2,184 lbs.
Foreign shipment, tight boxed (75 c. f.).....	2,685 lbs.
Code word complete as shown.....	(Ability)

For tools and attachments, see pages 62 to 66.



No. 3 Universal Milling Machine.

**Patented Jan. 9, 1900.
Others Pending.**

Specification of No. 3 Universal Milling Machine.

In this machine are embodied the most advanced features of mill-machine construction, and it is well adapted to a heavy class of machine and tool work, gear cutting, heavy fluting, etc., as required in the manufacture of dynamos, motors, automobiles, steam pumps, rock drills, and general machinery.

Power feed in all directions, longitudinal, in and out, and up and down, are provided, and all these feeds are stopped, started, and reversed by one and the same handle, at front of knee.

Special attention is directed to the feed mechanism. A change gear box located inside the column affords eighteen changes, ranging from .003 to $\frac{1}{4}$ inch per revolution of the spindle; and any desired feed is instantly obtained by simply turning a handle to the corresponding number on the index disk, and all these changes are available for all three feeds and in any direction and all positions.

The elevating screw is fixed and does not pass through the floor, which is an important advantage in fireproof buildings. A revolving nut is used on the elevating screw and is fitted with a ball thrust giving a very easy movement.

The table is wide and deep, with three T slots, centrally driven, and has a bearing more than half its length in the swivel block, which is fitted with a taper gib. The knee provides a large in and out adjustment, has a wide bearing in the column, and special attention has been paid to stiffening it against vibrations.

The dividing head is fitted with a large dial directly on the spindle, and, to use this, the worm shaft is readily withdrawn as a whole.

This dial carries index circles of 4, 6, 16, and 18 holes, and can be used in all positions of the head, and will be found especially desirable for plain, rapid work in milling flats, squares, hexagons, etc., on punches, bolts, ends of shafts, etc.

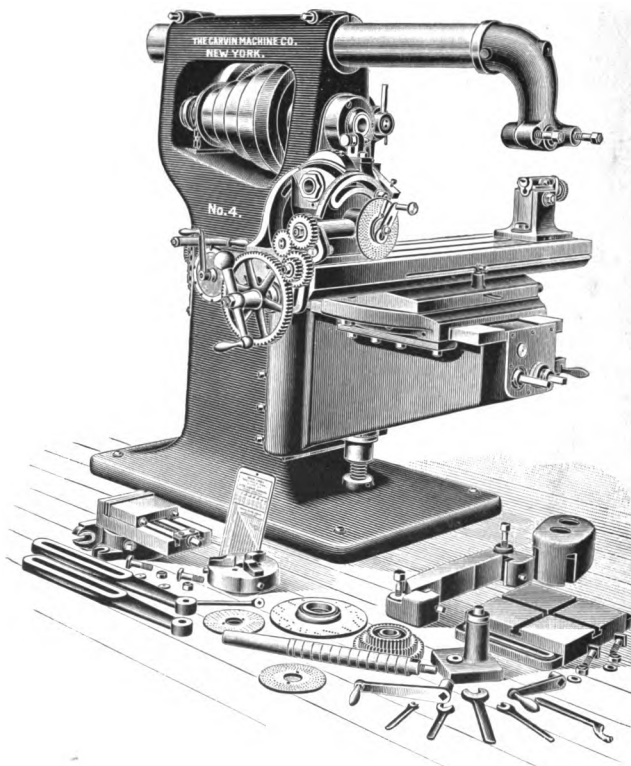
In the swivel vise, provision is made for setting up the vise horizontally or vertically, and in either position the vise can be set to any angle on the graduated base and quickly bound.

Micrometer readings are provided for all adjustments, and our standard form of spindle bearing, arm, and braces, outboard center, etc., are used.

For general description, see page 6.

Dimensions of table.....	9x48 in.
Vertical adjustment under spindle.....	17 in.
Adjustment in line with spindle.....	11 $\frac{5}{8}$ in.
Length of automatic feed of table.....	30 in.
Greatest distance from end of spindle to outboard bearing.....	24 $\frac{3}{4}$ in.
Swing under arm.....	14 $\frac{1}{2}$ in.
Front spindle bearing.....	3 $\frac{1}{2}$ x5 in.
Arbor hole in spindle, B. & S. taper.....	No. 11
Largest diameter of cone.....	13 $\frac{1}{2}$ in.
Change of speed by cone and back gear, 8, increased by countershaft to.....	16
Width of belt required.....	3 in.
Number of feed changes.....	18
Bearing of table in swivel block.....	22 in.
Swing of centers.....	12 $\frac{1}{4}$ in.
Distance between centers.....	28 in.
Diameter of hole through dividing head.....	1 $\frac{1}{4}$ in.
Size of vise furnished.....	No. 4
Friction pulleys on countershaft.....	14x4 in.
Speed of countershaft, revolutions per minute.....	120-160
Floor space required.....	76x98 in.
Domestic shipment, crated, weight.....	3,684 lbs.
Foreign shipment, tight boxed (101 c. f.).....	4,380 lbs.
Code word, complete, as shown.....	(Abound)

For tools and attachments, see pages 62 to 66.



No. 4 Universal Milling Machine.

Patented Jan. 9, 1900.

Others pending.

Specification of No. 4 Universal Milling Machine.

Several new features of construction are introduced, which add to the general efficiency. The table is wide and deep, centrally driven, fitted with a taper gib, and has three T-slots. The swivel block provides long bearing for the table, and can be set to 45 degrees either way, and solidly bound by a large bolt at each end.

The saddle on the knee is fitted with square lock gibbing, which avoids the collapsing pressure on the knee from overhung work.

The knee has a very wide bearing in the face of the column, and the upper end is extended to afford the utmost support when working far out from the base. A very large in and out adjustment is afforded, and the knee is fitted with square gib surfaces on top, and is internally stiffened to resist springing and vibration.

Power feed with reverse is provided in all directions, and all feeds can be thrown in, tripped, and reversed by one and the same handle at the front of the knee. An independent trip lever is provided for the table.

Our patented system of feeds is used, giving 18 changes, from .003 to $\frac{1}{4}$ inch, any one of which is instantly obtained by turning a handle to the corresponding number on an index disk, and all changes are available for all three classes of feed and in all positions.

The elevating screw does not pass through the floor, and is fitted with ball thrust. The dividing head is fitted with a large and accurate dividing worm gear, and also with a large dial on the front end of the spindle, provision being made for conveniently withdrawing the worm shaft when using the dial.

This dial carries index circles of 4, 6, 16, and 18 holes, and can be used in all positions of the head, and will be found especially desirable for plain, rapid work in milling flats, squares, hexagons, etc., on punches, bolts, ends of shafts, etc.

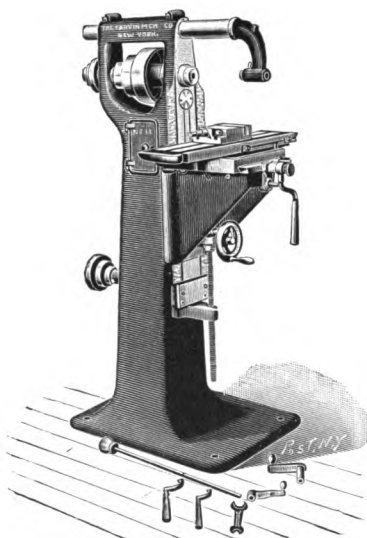
In the swivel vise, provision is made for setting up the vise horizontally or vertically, and in either position the vise can be set to any angle on the graduated base and quickly bound.

Our standard form of arm and braces, outboard center, taper spindle bearing, etc., are used.

For general description, see page 6.

Dimensions of table.....	12 $\frac{1}{2}$ x54 in.
Extreme distance from center of spindle to top of table.....	17 in.
Adjustment in line with spindle.....	12 $\frac{1}{2}$ in.
Length of automatic feed of table.....	33 in.
Greatest distance from end of spindle to outboard bearing....	26 $\frac{1}{4}$ in.
Swing under arm.....	15 in.
Front spindle bearing.....	4 $\frac{1}{4}$ x6 in.
Arbor hole in spindle, B. & S. taper.....	No. 12
Largest diameter of cone.....	14 $\frac{1}{4}$ in.
Change of speed by cone and back gear, 8, increased by countershaft to.....	16
Width of belt required.....	3 $\frac{1}{2}$ in.
Number of feed changes.....	18
Bearing of table in swivel block.....	29 $\frac{1}{2}$ in.
Swing of centers.....	16 $\frac{1}{4}$ in.
Distance between centers.....	28 in.
Diameter of hole through dividing head.....	1 $\frac{1}{2}$ in.
Size of vise furnished.....	No. 5
Friction pulleys on countershaft.....	16x4 in.
Speed of countershaft, revolutions per minute.....	100-140
Floor space required.....	120x96 in.
Domestic shipment, crated, weight.....	6,250 lbs.
Foreign shipment, tight boxed (170 c. f.).....	7,350 lbs.
Code word, complete, as shown.....	(Abstract)

For tools and attachments, see pages 62 to 66.



Specification of No. 11 Milling Machine.

This machine is adapted to the lightest kinds of small milling and light manufacturing, and suitable for jewelers, makers of electrical goods, brass workers, sewing-machine manufacturers, and others.

It is provided with our standard spindle bearing, and the in and out and vertical adjustments have micrometer readings.

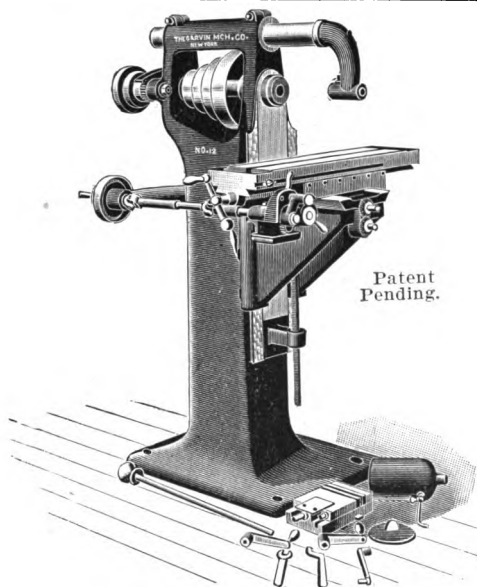
The feed is by rack and pinion transmitted through a clutch and self-oiling worm and worm gears, all located inside the column.

The table has an oil channel all around, and will trip automatically when feeding in either direction, and a quick return is obtained by the lever on the pinion shaft.

Three changes of feed are provided.

Dimensions of table inside oil pockets.....	$3\frac{3}{4} \times 21\frac{1}{4}$ in.
Vertical adjustment under spindle.....	$8\frac{1}{2}$ in.
Adjustment in line with spindle.....	$3\frac{1}{2}$ in.
Length of automatic feed of table.....	$12\frac{1}{4}$ in.
Greatest distance from end of spindle to outboard bearing....	9 in.
Swing under arm.....	$8\frac{1}{2}$ in.
Front spindle bearing.....	$1\frac{7}{8} \times 3$ in.
Largest diameter of cone.....	$6\frac{1}{2}$ in.
Number of steps on cone.....	3
Width of belt required.....	2 in.
Number of feed changes.....	3
Tight and loose pulleys on countershaft.....	$8 \times 2\frac{1}{4}$ in.
Speed of countershaft, revolutions per minute.....	165
Floor space required.....	38×36 in.
Domestic shipment, crated, weight.....	650 lbs.
Foreign shipment, tight boxed (21 c. f.).....	975 lbs.
Code word, as shown, with No. 2 vise.....	(Abode)

For tools and attachments, see pages 54 to 66.



Specification of No. 12 Milling Machine.

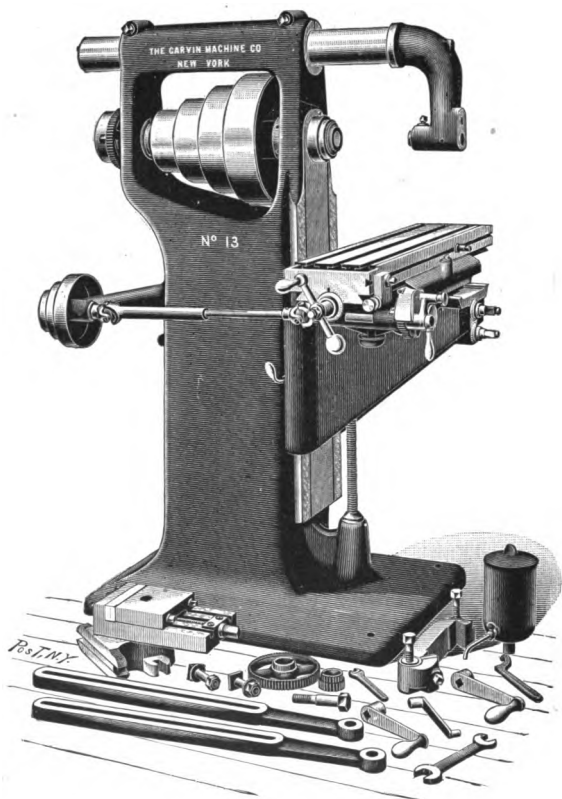
This machine is designed for all kinds of light manufacturing and small milling, and is especially strong and substantial.

It is provided with our standard form of arm, outboard center, spindle bearing, micrometer adjustments, feed cone and gear changes, belt tightener, feed cone bracket, etc.

The table is provided with oil pockets and channels, and is fed by coarse pitch screw driven by worm and bronze gear, running in oil and fitted with reverse motion, operated by small handle at the front, and will trip automatically when feeding in either direction.

Dimensions of table, inside oil pockets.....	6 $\frac{3}{4}$ x30 in.
Vertical adjustment under spindle.....	14 in.
Adjustment in line with spindle.....	6 $\frac{3}{4}$ in.
Length of automatic feed of table.....	16 in.
Greatest distance from end of spindle to outboard bearing....	11 in.
Swing under arm.....	9 $\frac{1}{2}$ in.
Front spindle bearing.....	2 $\frac{3}{8}$ x3 $\frac{1}{2}$ in.
Largest diameter of cone.....	9 in.
Number of steps on cone.....	4
Width of belt required.....	2 $\frac{1}{4}$ in.
Number of feed changes.....	6
Tight and loose pulleys on countershaft.....	10x2 $\frac{1}{2}$ in.
Speed of countershaft, revolutions per minute.....	125
Floor space required.....	47x38 in.
Domestic shipment, crated, weight.....	968 lbs.
Foreign shipment, tight boxed (50 c. f.).....	1,239 lbs.
Code word, as shown, with No. 3 vise.....	(Abrade)

For tools and attachments, see pages 54 to 66.



No. 13 Milling Machine.

Patent Pending.

Specification of No. 13 Milling Machine.

This machine is adapted to a large range of general milling, jobbing, light manufacturing work, and tool work. It has special advantages in point of size and weight and in the facility of adjustment and means of securing work, afforded by the wide table, and T slots.

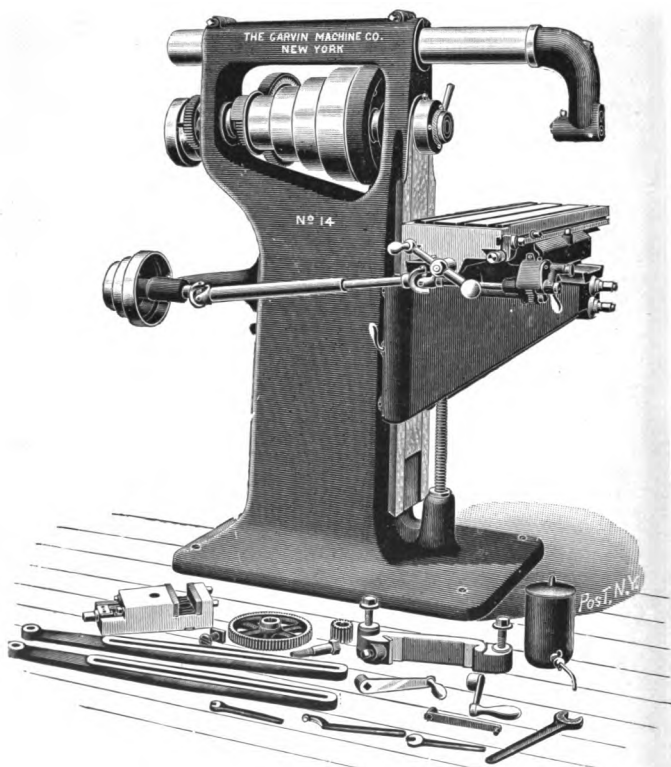
The feed is by hardened steel worm and bronze gear, running in oil, and is fitted with a reverse motion operated by a small handle at the front, and will trip automatically at any point when feeding in either direction.

The swivel vise can be set horizontally or vertically on the table, and set at any angle in the graduated base, and quickly bound. The arbor is drawn in or forced out by a shouldered screw fixed in the rear end of the spindle.

It is provided with our standard spindle bearing, standard micrometer adjustments, and improved feed cone bracket.

Dimensions of table inside oil pockets.....	7½x29½ in.
Vertical adjustment under spindle.....	19½ in.
Adjustment in line with spindle.....	9 in.
Length of automatic feed of table.....	20 in.
Greatest distance from end of spindle to outboard bearing....	14 in.
Swing under arm.....	12½ in.
Front spindle bearing.....	2 13-16x4½ in.
Arbor hole in spindle, B. & S. taper.....	No. 10
Largest diameter of cone.....	11¾ in.
Changes of speed by cone 4, increased by countershaft to.....	8
Width of belt required.....	3 in.
Number of feed changes.....	12
Friction pulleys on countershaft.....	14x4 in.
Speed of countershaft, revolutions per minute.....	80-100
Floor space required.....	60x48 in.
Domestic shipment, crated, weight.....	1,575 lbs.
Foreign shipment, tight boxed (45 c. f.).....	1,925 lbs.
Code word, as shown, with No. 4 swivel vise.....	(Abridge)

For tools and attachments, see pages 52 to 66.



No. 14 Milling Machine.

Patent Pending.

Specification of No. 14 Milling Machine.

This machine is a well-proportioned tool, strong and heavy, and intended for a higher grade of manufacturing, tool work, jobbing, and general milling.

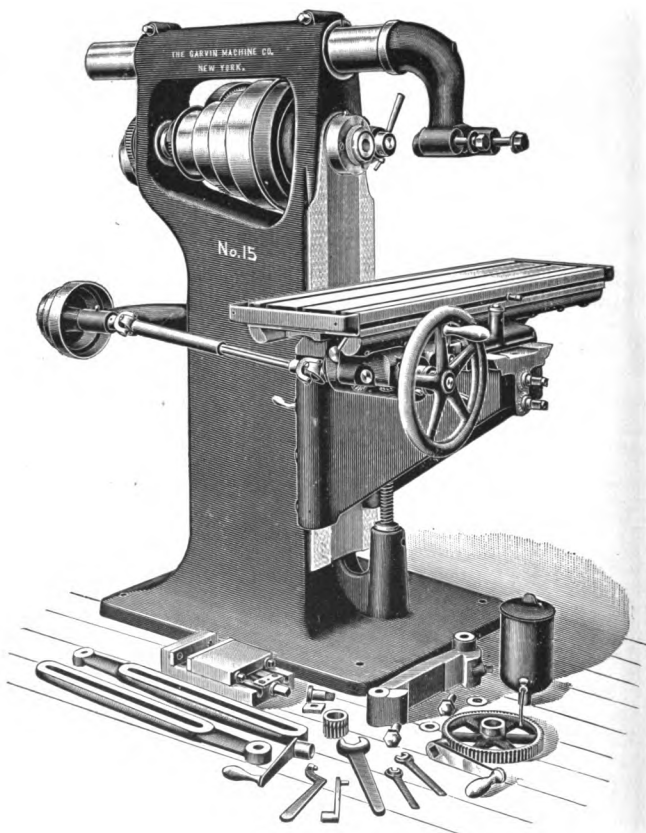
It is similar in size and general appearance to our No. 2 Universal Miller, has a four-step cone, and is fitted with our standard form of arm and braces, outboard center, spindle bearing, micrometer adjustments, belt tightener bracket, draw-in rod for arbor, ball thrusts, etc.

The table has three T slots and is provided with oil pockets and channels. The feed is by a coarse pitch screw, driven by a hardened steel worm and bronze gear, moving in an oil bath, is fitted with a reverse motion operated by a small lever at the side, can be changed while using, and will trip automatically when feeding in either direction. Changes of feed are provided by cone pulleys and change gears.

The knee provides a large in and out adjustment, and is braced to resist springing and vibration, and fitted with a ball thrust elevating screw.

Dimensions of table inside oil pockets.....	9x37¾ in.
Vertical adjustment under spindle.....	21½ in.
Adjustment in line with spindle.....	9½ in.
Length of automatic feed of table.....	28 in.
Greatest distance from end of spindle to outboard bearing....	16 in.
Swing under arm	12½ in.
Front spindle bearing.....	3x4¾ in.
Arbor hole in spindle, B. & S. taper.....	No. 10
Largest diameter of cone.....	11¾ in.
Change of speed by cone and back gear 8, increased by countershaft to.....	16
Width of belt required.....	3 in.
Number of feed changes.....	12
Friction pulleys on countershaft.....	14x4 in.
Speed of countershaft, revolutions per minute.....	110-150
Floor space required.....	68x53 in.
Domestic shipment, crated, weight.....	2,063 lbs.
Foreign shipment, tight boxed (74 c. f.).....	2,488 lbs.
Code word, as shown, with No. 4 vise.....	(Abreast)

For tools and attachments, see pages 52 to 66.



No. 15 Milling Machine.

Patent Pending.

Specification of No. 15 Milling Machine.

This machine is specially adapted for general plain milling, for which purpose it has been very carefully designed. It is provided with our standard form of arm and braces, outboard center, spindle bearing, micrometer adjustments, belt tightener, feed pulley bracket, ball thrust, etc.

The table is extra wide, with oil channels, and is provided with three T slots.

The table is fed by a large, coarse pitch bronze screw running in oil and engaging a spiral rack or section of nut cut on the under side of the table.

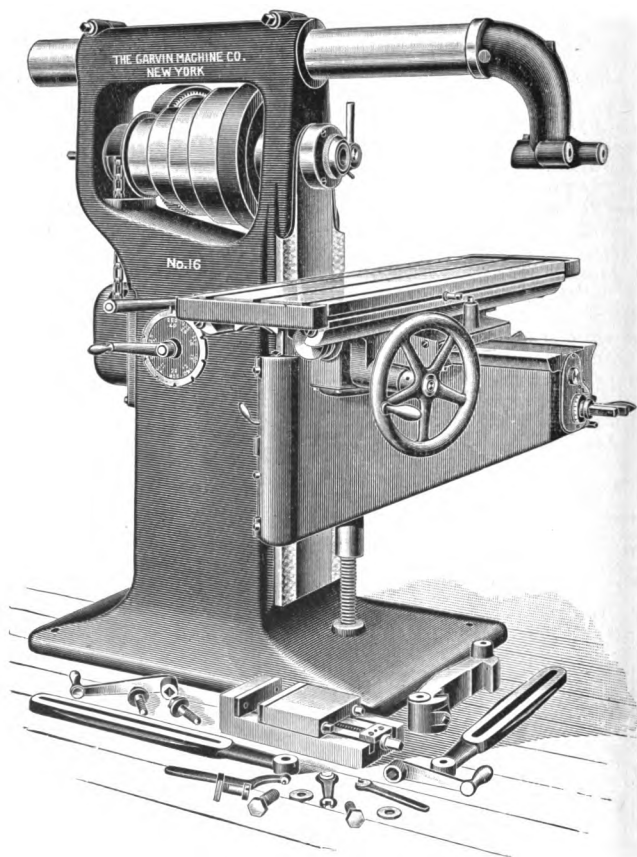
This bronze screw is made in two sections for take-up, and fitted with center ball thrust and large hand wheel, which gives perfect control of the slide and great ease of movement.

The knee has a long bearing on the column, and gives a large range of in and out adjustment, and is ribbed and stiffened to resist springing and vibration.

The elevating screw is fitted with ball thrust. The feed changes are obtained by cone and change gears, and the greatest belt power is available for the fastest feeds. The feed is reversible while running, by throwing a small handle at the front of the knee.

Dimensions of table inside oil pockets.....	12x42 in.
Vertical adjustment under spindle.....	19½ in.
Adjustment in line with spindle.....	7⅝ in.
Length of automatic feed of table.....	42 in.
Greatest distance from end of spindle to outboard bearing....	17 in.
Swing under arm.....	13½ in.
Front spindle bearing.....	3x4¾ in.
Arbor hole in spindle, B. & S. taper.....	No. 10
Largest diameter of cone.....	12½ in.
Change of speed by cone and back gears, 8, increased by countershaft to.....	16
Width of belt required.....	3 in.
Number of feed changes.....	12
Friction pulleys on countershaft.....	14x4 in.
Speed of countershaft; revolutions per minute.....	100-150
Floor space required.....	76x58 in.
Domestic shipment, crated, weight.....	2,530 lbs.
Foreign shipment, tight boxed (73 c. f.).....	2,930 lbs.
Code word, as shown, with No. 4 vise.....	(Abroad)

For tools and attachments, see pages 52 to 66.



No. 16 Milling Machine.

Patented Jan. 9, 1900.

Others pending.

Specification of No. 16 Milling Machine.

This machine is fitted for heavy milling of any description, and is a suitable tool for machine tool and engine builders and general manufacturing.

The machine is fitted with our standard form of spindle bearing, arm, and braces.

The spindle is large and fitted with a No. 11 B. & S. taper hole, and is driven by a four-step cone back geared $6\frac{1}{2}$ to 1.

The table is wide and heavy, and provided with three T slots and oil channels, and fitted with taper gib. The table is fed by a large bronze worm, made in two sections to take up wear, and running in oil and engaging in a screw rack cut in the bottom of the table its whole length. This arrangement produces a feed motion unequalled for smoothness and durability under heavy work. The hand feed is provided by the large hand wheel in front, which affords an easy movement and is always in position.

In this machine, power feed with reverse is provided in all direction table feed, in and out and up and down, and all are thrown in, tripped and reversed by a small lever at the front of the knee.

Our patented system of feeds is introduced in this machine, whereby any feed from .003 to $\frac{1}{4}$ in. is instantly obtained by simply turning a handle around to the required number on the index dial.

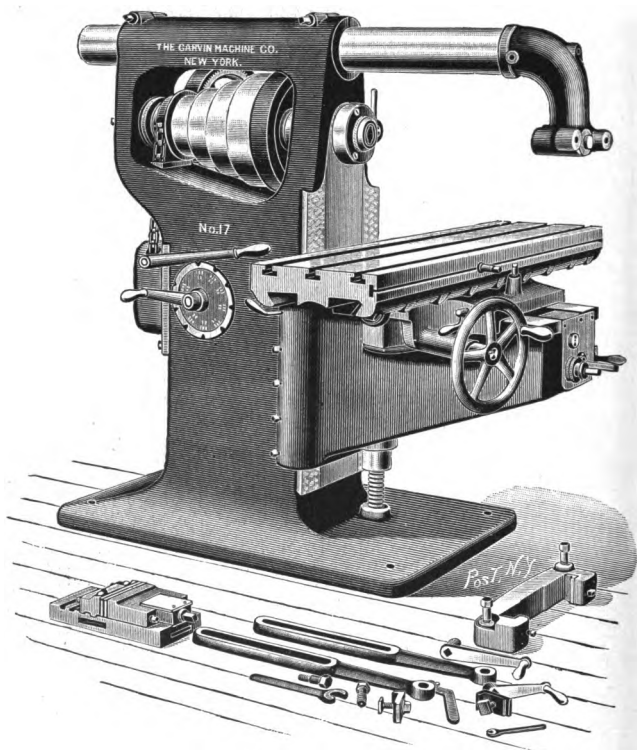
Eighteen changes are available, and these are applicable to all three classes of feeds. The feed is driven by chain, with slip friction to avoid accidents.

A fixed screw and rotary nut fitted with ball thrusts is used to raise the knee, which gives a very easy lift and requires no hole in the floor, which is an advantage in fireproof buildings. The in and out and elevating screws are provided with micrometer dials.

The knee has a large bearing on the column, and is ribbed on the inside to resist springing and vibration.

Dimensions of table inside oil pockets.....	13x50 in.
Vertical adjustment under spindle.....	18 in.
Adjustment in line with spindle.....	12 $\frac{3}{4}$ in.
Length of automatic feed of table.....	41 in.
Greatest distance from end of spindle to outboard bearing....	24 in.
Swing under arm.....	14 $\frac{1}{2}$ in.
Front spindle bearing.....	3 9-16x5 in.
Arbor hole in spindle, B. & S. taper.....	No. 11
Largest diameter of cone.....	13 $\frac{1}{2}$ in.
Change of speed by cone and back gear, 8, increased by countershaft to.....	16
Width of belt required.....	3 in.
Number of feed changes.....	18
Friction pulleys on countershaft.....	14x4 in.
Speed of countershaft, revolutions per minute.....	120-160
Floor space required.....	76x98 in.
Domestic shipment, crated, weight.....	3,650 lbs.
Foreign shipment, tight boxed (107 c. f.).....	4,550 lbs.
Code word, as shown with No. 5 vise.....	(Accede)

For tools and attachments, see pages 52 to 66.



No. 17 Milling Machine.

Patented Jan. 9, 1900

Others pending.

Specification of No. 17 Milling Machine.

This machine is built on the same design as our No. 16, but heavily proportioned for large work in machinery- and tool-building shops, railway shops, engine and electric works, etc.

The arm is large, and fitted with our standard form of outboard center and heavy braces. The spindle runs in large, solid bronze boxes of our standard form, and is fitted with pull-in rod and driving slot for large cutters.

The spindle is driven by a four-step cone, back geared 10 to 1.

The knee has a bearing on the column 17 inches wide, and is extended upward and braced internally to secure the utmost solidity.

The top of the knee is provided with square, gibbed surfaces to withstand the pressure of long, overhanging work, and enables the saddle to be solidly clamped without springing the knee. The elevating screw is fixed and does not pass through the floor, and is fitted with a rotary nut and ball thrust and geared to give an easy movement.

The table is wide and deep, with oil channels and T-slots, and fed by two large bronze worms running in oil and engaging with a solid screw rack or section of nut cut on the under side of the table. The bronze worms are adjustable to take up any wear, and the thrust is taken on large center ball thrusts. The hand feed is by large hand wheel in front.

With this machine there is power feed with reverse in all directions, table feed, in and out, up and down. These feeds are all thrown in, tripped, and reversed by one lever at the front of the knee, but a separate trip lever is also provided for the table.

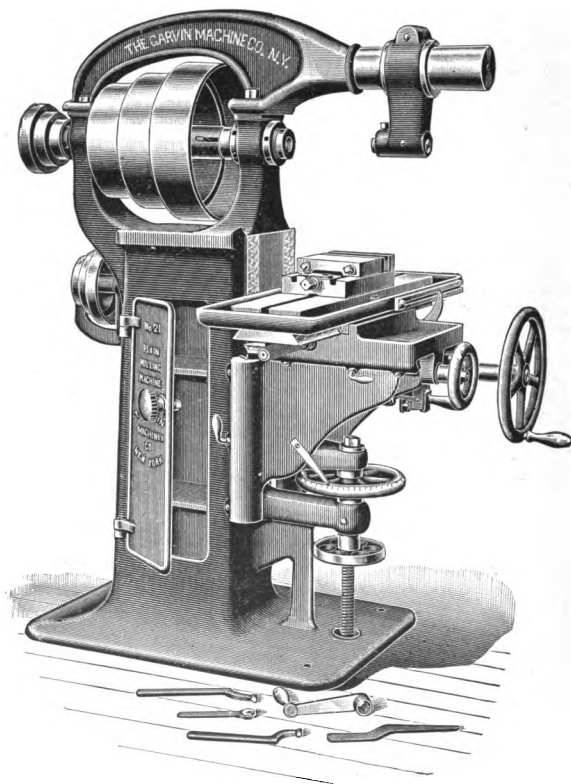
The feed-change mechanism is our patented system, whereby eighteen changes are provided and any feed is instantly obtained by turning a handle around to the corresponding number on the index dial.

The feed is positively driven by heavy chain, with take up and slip friction to prevent accidents, and transmitted to the knee and there reduced by worm gearing.

A large No. 6 Vise, with adjustable back jaw, is furnished.

Dimensions of table inside oil pockets.....	61½x15 in.
Extreme distance from center of spindle to top of table.....	17¾ in.
Adjustment in line with spindle.....	12¾ in.
Length of automatic feed of table.....	49 in.
Greatest distance from end of spindle to outboard bearing....	26½ in.
Swing under arm.....	15 in.
Front spindle bearing.....	4¼x6 in.
Arbor hole in spindle, B. & S. taper.....	No. 12
Largest diameter of cone.....	14¼ in.
Change of speed by cone and back gear, 8, increased by countershaft to.....	16
Width of belt required.....	3½ in.
Number of feed changes.....	18
Friction pulleys on countershaft.....	16x4 in.
Speed of countershaft, revolutions per minute.....	100-140
Floor space required.....	84x108 in.
Domestic shipment, crated, weight.....	5,900 lbs.
Foreign shipment, tight boxed (150 c. f.).....	7,000 lbs.
Code word, as shown, with No. 6 vise.....	(Acclaim)

For tools and attachments, see pages 52 to 66.



No. 21 Plain Milling Machine.

Specification of No. 21 Milling Machine.

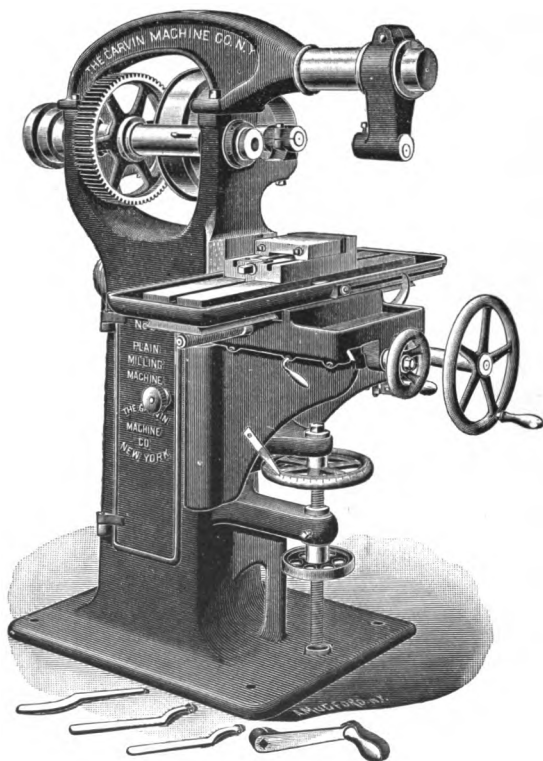
This is a plain, substantial machine, adapted for the ordinary run of surface milling, and is well built, and sold for a low price. The spindle runs in adjustable bronze boxes, and is driven by a very large cone and wide belt, so that there is ample power. The overhanging arm is large and well proportioned, and carries our standard out-board center.

The feed is by a coarse pitch screw driven by a self-oiling worm inclosed in a neat box, and will trip automatically in either direction.

The quick return is by a large hand wheel, and the lateral and vertical adjustments are by hand wheels, the vertical adjustment reading to thousandths of an inch.

Dimensions of table inside oil pockets.....	6x30 in.
Vertical adjustment under spindle.....	14 in.
Adjustment in line with spindle.....	5 $\frac{3}{8}$ in.
Length of automatic feed of table.....	18 in.
Greatest distance from end of spindle to outboard bearing....	12 $\frac{1}{2}$ in.
Swing under arm.....	9 $\frac{1}{4}$ in.
Front spindle bearing.....	1 15-16x4 $\frac{1}{8}$ in.
Largest diameter of cone.....	14 in.
Number of steps on cone.....	3
Width of belt required.....	3 $\frac{3}{4}$ in.
Number of feed changes.....	3
Tight and loose pulleys on countershaft.....	14x4 in.
Speed of countershaft, revolutions per minute.....	100
Floor space required.....	53x56 in.
Domestic shipment, crated, weight.....	1,600 lbs.
Foreign shipment, tight boxed (58 c. f.).....	1,950 lbs.
Code word, as shown with No. 4 vise.....	(Absorb)

For tools and attachments, see pages 52 to 66.



No. 21 Back Geared Milling Machine.

Specification of No. 21 Back Geared Milling Machine.

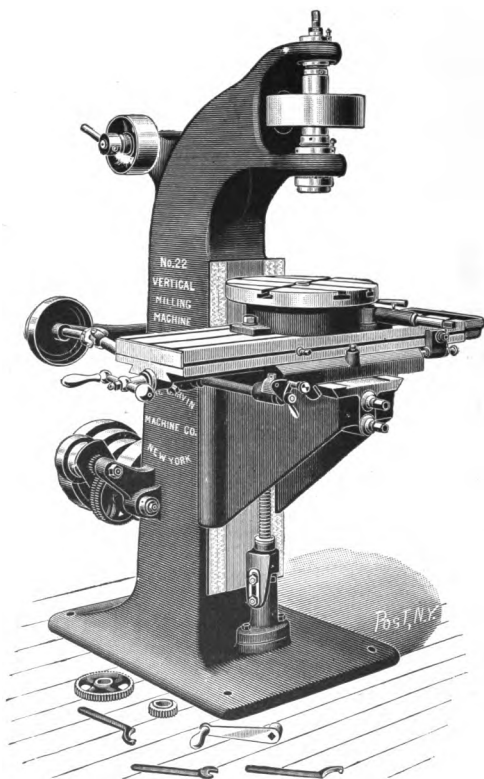
This machine is the same in general dimensions as our plain machine, but is geared for heavy cutting and is fitted with a stronger knee. A large amount of heavy plain and gang milling for general manufacturing can be done on this machine, for which the ample power, large rigid arm and wide table, driven by screw feed, make it well suited.

The table has a large oil-pan all around, has a long bearing in the saddle, is well fitted and provided with screw feed and automatic trip, and with quick return, by the large hand wheel in front, which affords an easy, rapid movement.

The graduated wheel on the elevating screw saves time in setting the work, and adds greatly to the convenience of the tool.

Dimensions of table inside oil pockets.....	6x30 in.
Vertical adjustment under spindle.....	12 in.
Adjustment in line with spindle.....	5½ in.
Length of automatic feed of table.....	18 in.
Greatest distance from end of spindle to outboard bearing....	13 in.
Swing under arm.....	9¼ in.
Front spindle bearing.....	1 15-16x4½ in.
Largest diameter of cone.....	12 in.
Change of speed by cone, 3, increased by countershaft to.....	6
Width of belt required.....	3 in.
Number of feed changes.....	3
Tight and loose pulleys on countershaft.....	12x3½ in.
Speed of countershaft, revolutions per minute.....	110-240
Floor space required.....	53x56 in.
Domestic shipment, crated, weight.....	1,650 lbs.
Foreign shipment, tight boxed (58 c. f.).....	2,000 lbs.
Code word, as shown, with No. 4 vise.....	(Absurd)

For tools and attachments, see pages 52 to 66.



No. 22 Vertical Milling Machine.

Patent Pending.

Specification of No. 22 Vertical Milling Machine.

A vertical machine possesses a number of positive advantages in the very convenient position occupied by the work and the large surface that can be covered. These machines are well adapted for face milling, milling out recesses, T slots, spotting off bosses, etc.

A large table, fitted with oil channels and three slots, is provided, and on this can be mounted a hand-feed rotary table. This rotary table presents a large surface, and is entirely protected. T slots covering the entire surface are provided, and the table is fitted with a taper hole for centering work.

The knee affords a large range of adjustment, and is ribbed to prevent spring and vibration.

The elevating screw is fitted with ball thrusts for sensitive movement, and is arranged with an adjustable clamp stop acting against pin on the horn at the base. This stop blocks the rotation of the screw, and can be conveniently set to limit the run of the knee between adjustable gauge limits for milling different levels.

Power feed with reverse and automatic trip are provided for the table, and the reverse can be operated while running by a small lever at the front.

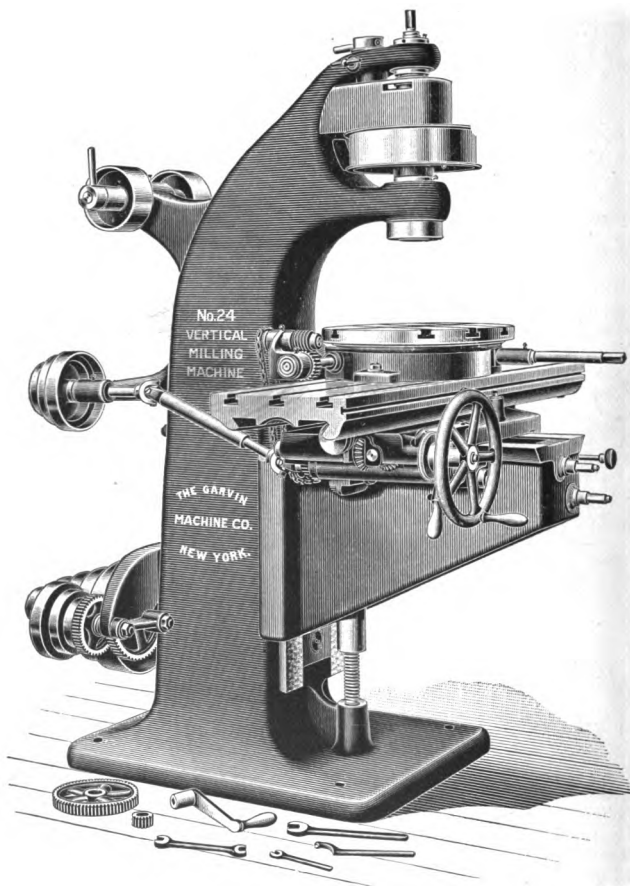
Feed changes are provided by cone pulley and change gears.

The upper feed pulley bracket is arranged to act as a belt tightener. The spindle is driven by a four-step cone and the idler pulleys above are arranged for tightening the belt.

Our standard form of spindle bearing, draw-in rod for arbor, micrometer adjustments, etc., are provided.

Dimensions of table inside oil pockets.....	9x37¾ in.
Diameter of rotary table.....	14 in.
Greatest distance from end of spindle to top of table.....	22½ in.
In and out adjustment.....	10¼ in.
Length of power feed to table.....	28 in.
Distance from center of spindle to face of column.....	9½ in.
Spindle bearing.....	2⅞x3¼ in.
Spindle pulley	9 in.
Width of belt.....	2¼ in.
Number of feed changes.....	12
Change of speed by cone 4, increased by countershaft to.....	8
Friction pulleys on countershaft.....	10x3 in.
Speed of countershaft, revolutions per minute.....	130-150
Floor space required.....	55x48 in.
Domestic shipment, crated, weight.....	1,525 lbs.
Foreign shipment, tight boxed (52 c. f.).....	1,875 lbs.
Code word, as shown, with rotary table.....	(Advisory)
Code word, without rotary table.....	(Advocate)

For tools and attachments, see pages 59, 60, and 62 to 66.



No. 24 Vertical Milling Machine.

Patent Pending.

Specification of No. 24 Vertical Milling Machine.

This is a machine of large range and ample power, and well adapted for surfacing cuts with face mills, milling T slots, circular work, recessing, etc.

Power feed, with reverse and automatic trip, is provided for the slide and rotary table and also for the in and out motion on the knee.

The spindle is driven from a cone pulley below, and is back geared 4 to 1, and is provided with our standard form of bearing and draw-in rod for arbor.

The table is wide and deep, and provided with three T slots, and driven by a bronze worm running in oil and engaging with a section of a nut cut at the bottom of the table. A large hand wheel in front gives an easy motion to the table by hand, and is fitted with micrometer reading.

The knee has a long bearing on column, provides a large in and out adjustment, and is stiffened to resist springing and vibration.

The elevating screw does not pass through the floor, and is fitted with ball thrust, giving a very easy motion to the knee.

The feed is driven by cone pulleys and change gears, and our standard form of pulley tightener bracket is provided. The feed can be reversed while running by throwing a small lever at the front of the saddle.

The in and out feed to the table is desirable for notching and taking cuts at right angles, and is thrown in and tripped by a small knob at the front of the knee, and is reversible while running by throwing a small handle at the left. Automatic trip in both directions is provided by adjustable dogs on the saddle. The micrometer reading for the movement of the table is useful in connection with the in and out feed.

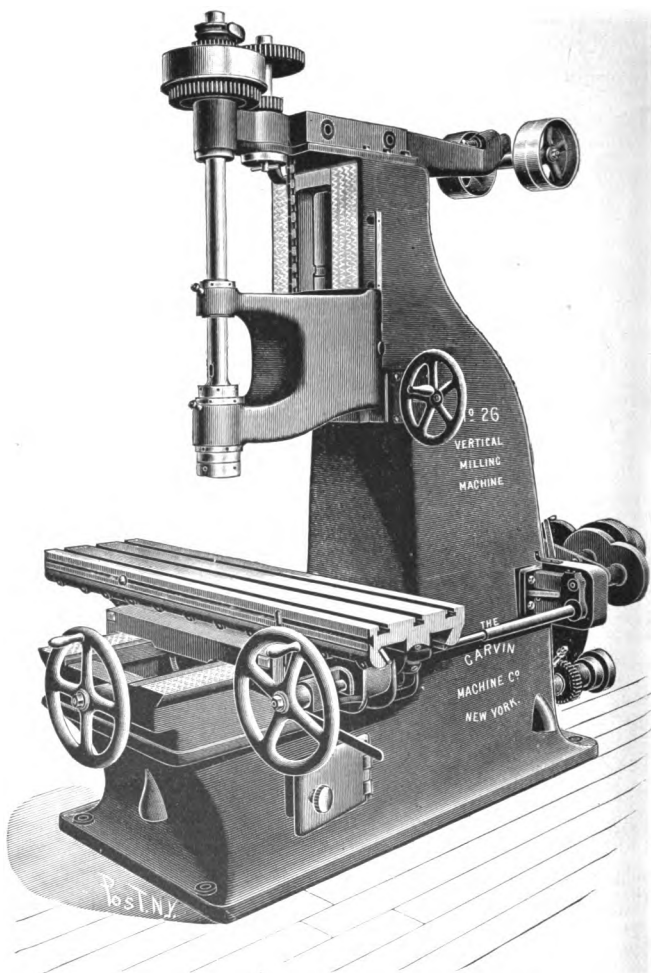
The rotary table is readily mounted at any position on the slide and is driven by a splined shaft so that the table can be carried along by the slide, which gives an adjustment for the cut and permits connecting straight and curved surfaces to be milled.

Power feed with reverse and automatic trip is provided, with the same number of changes as the slide feed. Hand feed is provided by a shaft at the front, and provision is made for throwing out the feed, so that any point of the table can be brought around at once. The table is large and entirely protected, and is provided with a number of T slots and a taper hole for centering work.

Our standard form of micrometer reading is provided for the in and out and vertical adjustments, and for the feed of the table.

Dimensions of table.....	13x50 in.
Diameter of rotary table.....	18 in.
Greatest distance from end of spindle to top of table.....	18½ in.
In and out adjustment.....	11¾ in.
Length of power feed to table.....	47 in.
Distance from center of spindle to face of column.....	11¼ in.
Spindle bearing.....	3x4½ in.
Taper hole in spindle, B. & S. taper.....	No. 10
Spindle pulley.....	12x3¼ in.
Width of belt.....	3 in.
Number of feed changes.....	12
Change of speed by cone and back gear, 8, increased by countershaft to.....	16
Friction pulleys on countershaft.....	12x3 in.
Speeds of countershaft, revolutions per minute.....	125-150
Floor space.....	75x100 in.
Domestic shipment, crated, weight.....	3,300 lbs.
Foreign shipment, tight boxed (131 c. f.).....	4,070 lbs.
Code word, as shown, with rotary table.....	(Ado)
Code word, without rotary table.....	(Adobe)

For tools and attachments, see pages 59, 60, and 62 to 66.



No. 26 Vertical Milling Machine with Plain Table.

Patent Pending.

Latest Photograph furnished on application.

Specification of No. 26 Vertical Milling Machine.

This is a large, heavy tool, intended for working on large castings, forgings, etc., as required in machine tool building, locomotive, and engine shops and heavy manufacturing. The machine is made in two styles—rotary table and plain table. The spindle runs in large bronze boxes, and is driven by a large four-step cone, back geared 10 to 1, and is fitted with a driving slot and cap for driving large cutters.

The sliding head has a long bearing on the column, and is balanced and has an easy movement by large hand wheel, and is fitted with a scale and pointer to indicate depths, and micrometer adjustment.

The column has a deep gap and the sliding head has a long, vertical run, so that large castings will come within the range of the machine. The slide of the plain machine is very wide and deep and provided with three T slots, and has a bearing of more than half its length on the saddle, and is provided with quick return by large hand wheel.

The in and out adjustment screw is also fitted with large hand wheel.

The table feed is by a large bronze worm running in oil and split to take up wear, and engaging with a screw rack cut on the under side of the slide. The table can be fed its whole length, and is provided with automatic trip and reverse.

Changes of feed are provided by cone pulley and change gears. Both driving belt and feed belt are provided with tightener.

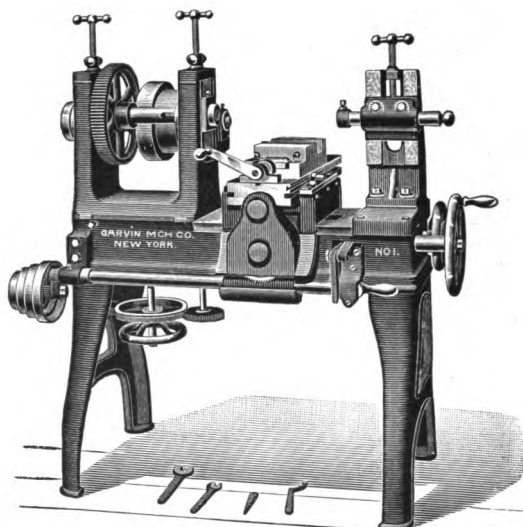
On the rotary table machine, power feed with reverse is provided in all directions.

The large rotary table is entirely protected and provided with a number of T slots covering the whole surface. Hand and power feed are provided, and are thrown in by clutch.

The saddle on which the rotary table is mounted is provided with both longitudinal and in and out feed by hand and power, controlled by clutches at the right. All power feeds are provided with reverse.

	Rotary table	Plain table
Dimensions of table.....	24 in. diam.	15x61 in.
Distance from end of spindle to table, highest adjustment	23½ in.	27½ in.
Distance from end of spindle to table, lowest adjustment	57½ in.	10¼ in.
Length of longitudinal feed.....	32 in.	57 in.
Length of cross feed.....	24 in.	25 in.
Adjustment of vertical head.....	17¼ in.	17¼ in.
Distance from center of spindle to face of column.....	16¼ in.	16¼ in.
Distance from center of spindle to rear of throat	24 in.	24 in.
Spindle bearing	3¾x8 7-16 in.	3¾x8 7-16 in.
Arbor hole in spindle, B. & S. taper.....	No. 12	No. 12
Largest diameter of cone.....	15 in.	15 in.
Change of speed by cone and back gear, 8, increased by countershaft to.....	16	16
Width of belt required.....	3½ in.	3½ in.
Number of feed changes.....	12	12
Friction pulleys on countershaft.....	16x4 in.	16x4 in.
Speed of countershaft, revolutions per minute.....	100-130	100-130
Floor space required.....	108x118 in.	108-118 in.
Height over all.....	101 in.	101 in.
Domestic shipment, crated, weight.....	7,900 lbs.	7,900 lbs.
Foreign shipment, tight boxed (278 c. f.).....	8,883 lbs.	8,883 lbs.
Code word, with oil pump and blower complete.	Abatement	Abator

For tools and attachments, see pages 54, 57, 59, 60, and 62 to 66.



Specification of No. 1 Lincoln Milling Machine.

This machine is particularly adapted for the production of large numbers of duplicate parts, as in the manufacture of guns, pistols, sewing machines, hardware specialties, etc.

The main spindle is strongly back geared and driven by 3 step-cone, and has standard Lincoln Miller taper hole $1\frac{1}{4}$ inches in diameter.

The spindle has a parallel adjustment by screws, ranging from $3\frac{1}{4}$ inches above the table to 3 inches above.

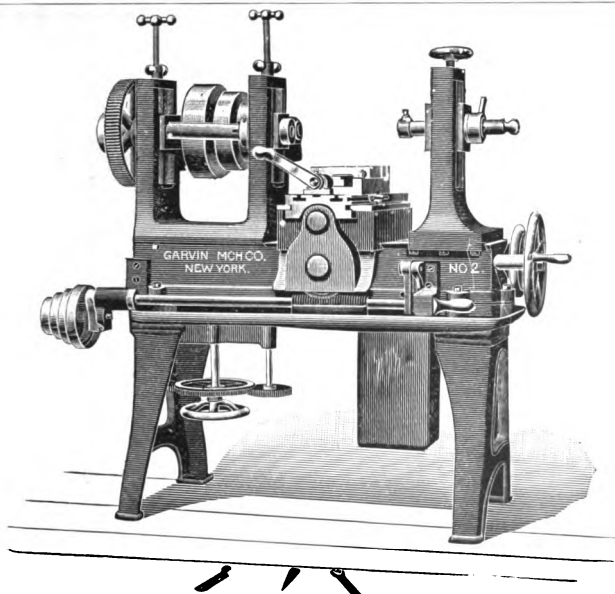
The tail stock is well braced, and the bearing block is quickly adjusted by screw and clamped.

The tail spindle has a quick-sliding movement and solid clamps, and carries our improved form of cylindrical outboard bearing.

The feed worm runs in oil and feed works are well protected.

Dimensions of table.....	$7\frac{1}{2} \times 28$ in.
Adjustment of spindle above table.....	$3\frac{1}{4} \times 8$ in.
Adjustment in line with spindle.....	6 in.
Length of automatic feed of table.....	20 in.
Maximum distance between head and tail stock.....	19 in.
Largest diameter of cone.....	$10\frac{1}{4}$ in.
Number of steps on cone.....	3
Width of belt required.....	$2\frac{1}{2}$ in.
Number of feed changes.....	4
Tight and loose pulleys on countershaft.....	12×3 in.
Speed of countershaft, revolutions per minute.....	190
Floor space required.....	61×58 in.
Domestic shipment, crated, weight.....	1,475 lbs.
Foreign shipment, tight boxed (74 c. f.).....	1,800 lbs.
Code word, as shown, with No. 5 vise.....	(Achieve)

For tools and attachments, see pages 54 to 66.



Specification of No. 2 Lincoln Milling Machine.

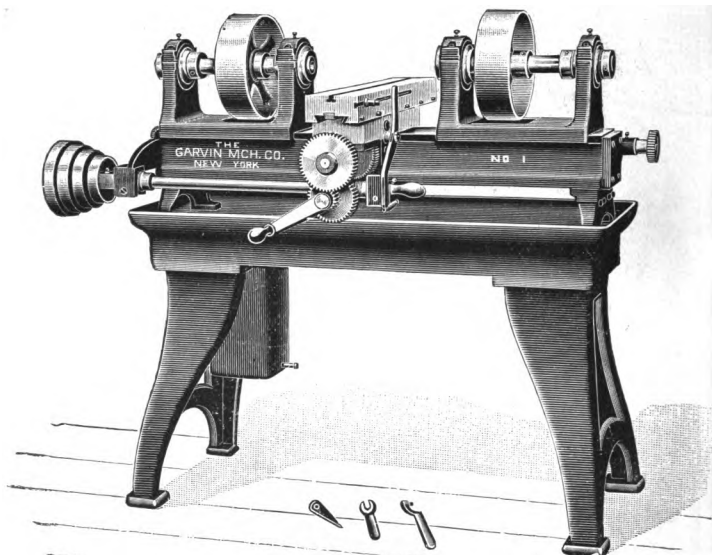
A large oil-pan, with adjustable extension shelves on each side, to catch the drip of the table, is provided.

The main spindle has a standard Lincoln Miller taper hole, and parallel adjustment by screw. The tail block is adjusted by hand wheel on top. The tail spindle has a sliding motion, and the spindle and block are clamped simultaneously by one movement of the lever.

The table is wide, deep, and has two T slots and center groove, is controlled by large hand wheel, and a special stop allows work to be run quickly up to the cutter, and when power feed is thrown in the stop automatically drops out.

Saddle has screw adjustment and positive screw stops.

Dimensions of table.....	71½x28¼ in.
Adjustment of spindle above table.....	2⅞x 9⅞ in.
Adjustment in line with spindle.....	6 in.
Length of automatic feed of table.....	21½ in.
Maximum distance between head and tail stock.....	20 in.
Largest diameter of cone.....	11½ in.
Number of steps on cone.....	3
Width of belt required.....	3 in.
Number of feed changes.....	4
Tight and loose pulleys on countershaft.....	12x4 in.
Speed of countershaft, revolutions per minute.....	190
Floor space required.....	61x60 in.
Domestic shipment, crated, weight.....	1,825 lbs.
Foreign shipment, tight boxed (74 c. f.).....	2,125 lbs.
Code word, as shown, with No. 5 vise.....	(Aconite)



Specification of No. 1 Duplex Milling Machine.

This machine is designed to meet the requirements of economical and rapid manufacturing of standard articles, such as hardware specialties, brass goods, typewriters, cash registers, etc. The great advantage of the tool lies in the fact that both sides of the piece are finished at once and are positively parallel.

The spindles are ground for high speed, and run in bronze cap boxes.

The head stocks are independently adjustable along the bed, and provided with large driving pulleys. The table has ample surface for holding fixtures, power feed with automatic trip and quick return.

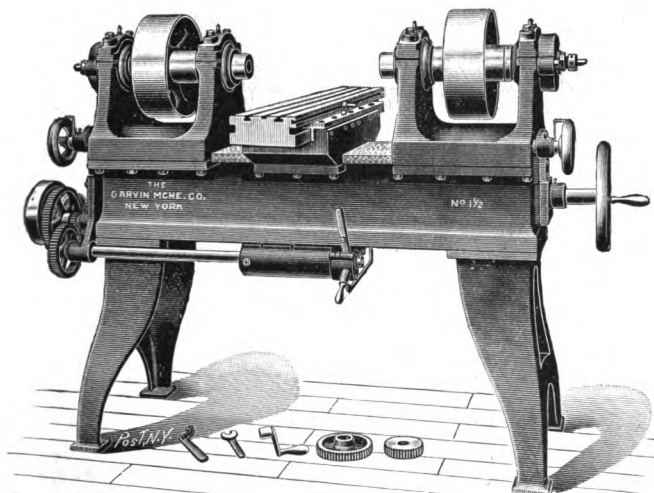
Changes of feed are by cone pulley driven from countershaft.

Large oil-pan, with oil reservoir and double strainers, is provided.

This machine is also built with vertical table.

Dimensions of table.....	5x23 in.
Maximum distance between uprights.....	16 in.
Length of automatic feed of table.....	14 in.
Spindle projects from uprights.....	$\frac{3}{4}$ in.
Dimensions of front spindle bearings.....	$1\frac{3}{4} \times 3\frac{1}{4}$ in.
Size of pulleys on spindles.....	$3\frac{1}{8} \times 10$ in.
Width of belt required.....	3 in.
Tight and loose pulleys on countershaft.....	14×4 in.
Speed of countershaft, revolutions per minute.....	100
Floor space required.....	68×40 in.
Domestic shipment, crated, weight.....	1,225 lbs.
Foreign shipment, tight boxed (46 c. f.).....	1,550 lbs.
Code word, as shown.....	(Acquire)

For cutters and attachments, see pages 54 to 66.



Specification of No. 1 $\frac{1}{2}$ and No. 2 Duplex Milling Machines.

In the No. 1 $\frac{1}{2}$ Machine the spindles are fixed, but in the No. 2 are independently adjustable in height, and in both the headstocks are adjustable along the bed and provided with micrometer readings.

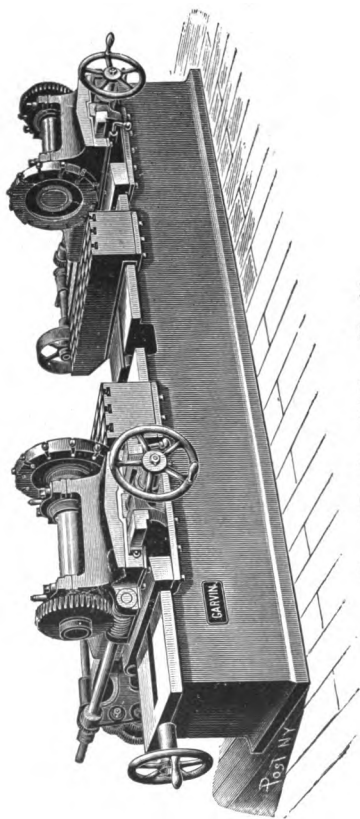
In the No. 1 $\frac{1}{2}$ the spindles are driven directly by belt, but in the No. 2 are geared 4 to 1 and driven by a three-step cone.

The spindles are large, the No. 1 $\frac{1}{2}$ Machine has bronze cap boxes, and the No. 2 Machine our standard form of spindle bearing.

The table is wide and deep, has a long bearing in saddle, and is fed by vertical rack and pinion driven direct by large worm gear below. Quick hand feed is by large hand wheel at end of bed.

Changes of feed are provided by cone pulleys and change gears.

	No 1 $\frac{1}{2}$.	No. 2.
Dimensions of table.....	6x38 in.	7 $\frac{1}{2}$ x38 in.
Length of automatic feed.....	26 in.	33 in.
Distance from center of spindle to top of table. 4 in.		
Adjustment of spindle over table.....		1 $\frac{3}{4}$ to 9 $\frac{1}{2}$ in.
Greatest distance between ends of spindles....	16 in.	27 in.
Least distance between ends of spindles.....	4 $\frac{3}{4}$ in.	6 $\frac{1}{2}$ in.
Taper hole in spindle.....	No. 10 B. & S.	No. 10 B. & S.
Back gearing.....		4 to 1
Pulleys on spindle.....	12x4 $\frac{1}{4}$ in.	9x4 $\frac{1}{4}$ in.
Width of belt.....	4 in.	4 in.
Number of speed changes.....		3
Number of feed changes.....	12	4
Tight and loose pulleys on countershaft.....	14x4 in.	12x3 in.
Speed of countershaft, revolutions per minute....	75	250
Floor space required.....	64x73 in.	76x90 in.
Domestic shipment, crated, weight.....	2,067 lbs.	2,700 lbs.
Foreign shipment, tight boxed	2,400 lbs.	3,200 lbs.
	69 c. f.	110 c. f.
Code word	(Accipient)	(Acquit)
Code word of vertical Table Machine....	(Accentor)	....



No. 4 Duplex Milling Machine.

Specification of No. 4 Duplex Milling Machine.

This machine is adapted for finishing the parallel sides of work and general surface cuts, and for facing off the ends of long pieces such as beds, girders, machine legs, etc.

The machine is set low, so that the work can be handled in the most efficient manner, and the accuracy of the work depends simply on the machine, and not on the setting, with the further economy of working on two sides or pieces at once.

The work tables are adjustable along the bed and provided with T slots for holding the work, and cross slots for squaring purposes.

The spindle heads are of the most substantial construction, with large spindles running in heavy bronze cap boxes and solidly supported taper gibs on bottom and sides, to prevent the least tendency to lift or chatter. The heads are adjusted and driven independently.

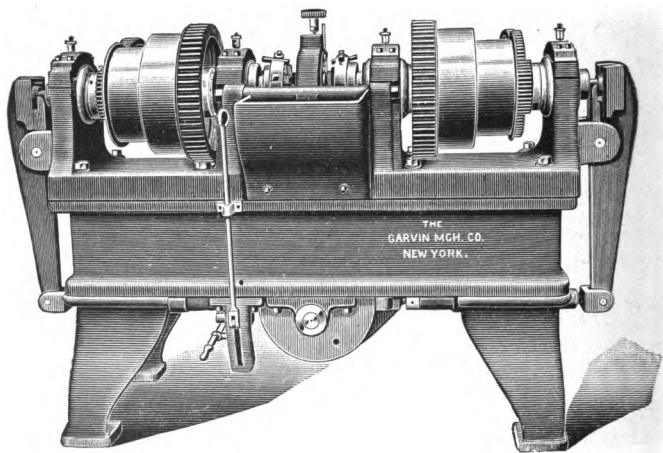
The adjusting screws are fitted with ball thrusts, and micrometer reading for the side adjustment of the heads is provided.

The heads are driven in the ratio of 20 to 1 by worm and gear running in oil and fitted with ball thrust.

The cutter heads are 16 inches diameter, and can be used to finish off large surfaces, and the machine may be operated as two independent machines.

The feed is controlled by a knob at the front on each head, and changes are provided by change gears.

Length of bed.....	12 ft.
Extreme distance between cutters.....	100 in.
Least distance between cutters.....	0
Height of spindle center above bed.....	12¾ in.
Diameter of cutters.....	16 in.
Travel of cutter head.....	26 in.
Gearing	20 to 1
Floor space required.....	13 ft., 8 in. x 6 ft. 8 in.
Tight and loose pulleys on countershaft.....	14x4 in.
Speed of countershaft, revolutions per minute.....	360
Weight, domestic shipment, crated.....	9,000 lbs.
Weight, foreign shipment, tight boxed (150 c. f.).....	10,000 lbs.
Code word, as shown.....	(Acquitment)



Double Face Milling Machine.

Specification of Double Face Milling Machine.

This machine will finish the entire face of steel disks, flanges, cover plates, gear wheels, sprockets, etc., on both sides true and parallel at one cut, and at the same time rough bore the hole and rough turn the rim.

The face of the work as it comes from the machine is in the best condition for polishing, and the method of operation is the perfection of speed and accuracy.

The work is well backed up under cut, and two pieces are operated on at a time on opposite sides, so that one piece is completed at every operation.

The facing tools are large mills with adjustable inserted teeth, which can be ground without altering the shape, and the size accurately maintained.

The fixture is set in a large oil pan in which the cutters are constantly immersed, but the machine is equally well adapted for dry work.

The work is quickly set, and is held without clamping, so that springing from that source is avoided. The mills are fed up simultaneously by cams with quick return and automatic trip.

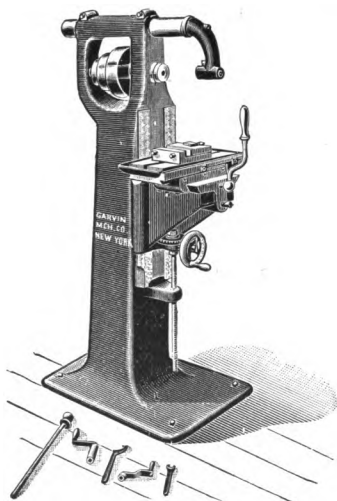
The spindles do not slide direct in the bearings, but through large sleeves, and a fine adjustment for the spindles is provided to regulate the thickness of the work.

The fixture is tied between the heads and bolted to the bed, uniting the machine into one solid structure.

A large two-step cone, back geared ten to one, furnishes ample driving power.

GENERAL DIMENSIONS.

Largest diameter of piece handled.....	12 in.
Largest diameter of driving cone.....	14 in.
Width of belt.....	4 in.
Diameter of spindle.....	3½ in.
Tight and loose pulleys on countershaft.....	12x4 in.
Speed of countershaft, revolutions per minute.....	210
Floor space.....	75x30 in.
Domestic shipment, crated, weight.....	4,000 lbs.
Foreign shipment, tight boxed (115 c. f.), weight.....	4,800 lbs.
Code word, complete, without tools.....	(Adonis)



Specification of No. 1 Hand Milling Machine.

This machine is designed for the rapid manipulation of small work, and will meet the wants of jewelers, makers of electrical goods, brass workers, sewing machine manufacturers, and others.

It is the same general size and design as our No. 11 Milling Machine, except the absence of power feed, and is fitted with our standard spindle bearing.

The table has an oil channel all around, and is fed by rack and pinion, operated by lever in front, giving a direct motion and quick return.

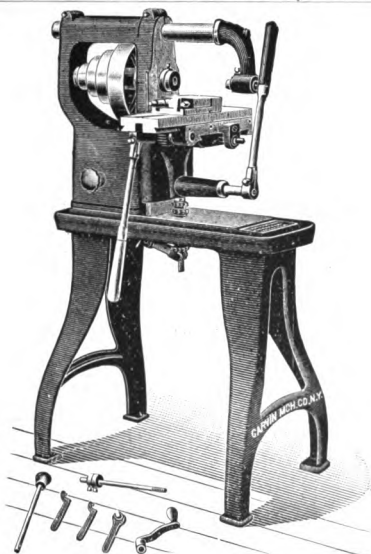
The in and out and vertical adjustments have micrometer readings.

Adjustable stops are provided on the table to limit the length of cut.

A dividing head can be furnished, arranged for cutting gears on centers or with spring collets.

Dimensions of table inside oil pockets.....	4x16 in.
Vertical adjustment under spindle.....	12 $\frac{3}{8}$ in.
Adjustment in line with spindle.....	3 $\frac{1}{8}$ in.
Length of feed.....	7 in.
Front spindle bearing.....	1 $\frac{1}{8}$ x3 in.
Largest diameter of cone.....	6 $\frac{1}{2}$ in.
Number of steps on cone.....	3
Width of belt required.....	2 in.
Tight and loose pulleys on countershaft.....	8x2 $\frac{1}{2}$ in.
Speed of countershaft, revolutions per minute.....	165
Floor space required.....	37x26 in.
Domestic shipment, crated, weight.....	525 lbs.
Foreign shipment, tight boxed (23 c. f.).....	675 lbs.
Code word, as shown, with No. 2 vise.....	(Acrostic)

For tools and attachments, see pages 54 to 66.



Specification of No. 2 Hand Milling Machine.

This machine has been brought to a high standard of efficiency, and is well adapted for light, quick cuts, as required in manufacturing the small parts of typesetting machines, typewriters, hardware articles, electric fixtures, etc.

The spindle has a taper bearing, running in a bronze box of our standard form, and the overhanging arm is also of standard design.

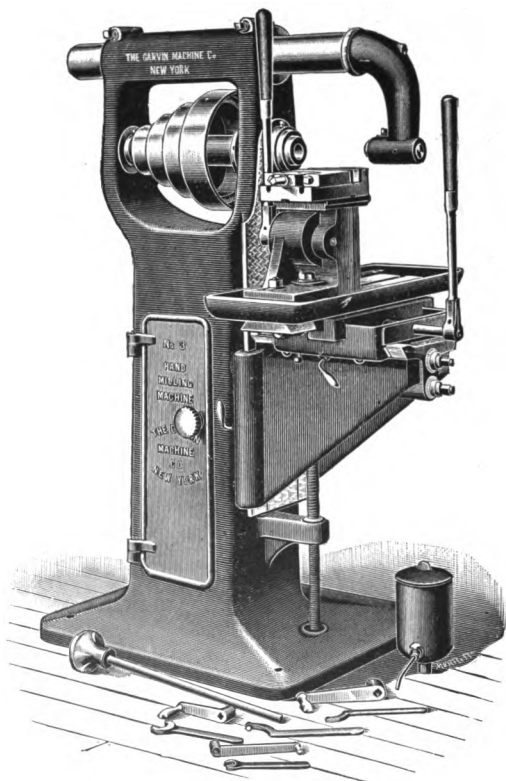
The table is fed by rack and pinion, with long, adjustable lever, and is provided with adjustable stops both ways.

The saddle has screw adjustment in line with the spindle.

The knee is moved by a long, adjustable lever through rack and pinion, and is nicely balanced in all positions, which give an easy sensitive motion and facilitates working. Adjustable screw stops in both directions are provided for the knee.

Dimensions of table.....	4 $\frac{5}{8}$ x16 $\frac{3}{4}$ in.
Vertical adjustment under spindle.....	4 $\frac{5}{8}$ in.
Adjustment in line with spindle.....	3 $\frac{1}{4}$ in.
Length of feed	5 $\frac{1}{4}$ in.
Front spindle bearing.....	1 $\frac{7}{8}$ x3 in.
Largest diameter of cone.....	8 in.
Number of steps on cone.....	4
Width of belt required.....	2 in.
Tight and loose pulleys on countershaft.....	8x3 in.
Speed of countershaft, revolutions per minute.....	150
Floor space required.....	38x40 in.
Domestic shipment, crated, weight	631 lbs.
Foreign shipment, tight boxed (18 c. f.).....	764 lbs.
Code word, as shown, with No. 2 vise.....	(Actress)

For tools and attachments, see pages 54 to 66.



No. 3 Hand Milling Machine.

Specification of No. 3 Hand Milling Machine.

This machine will handle the larger size work on which short, quick cuts are to be taken, and is well adapted for general use in manufacturing.

The arm, outboard center, spindle bearing, micrometer adjustments, etc., are those of our standard design.

The main slide has large oil channels all around, and is provided with a T slot by which the vertical milling head can be set at any position on the slide.

Adjustable plug stops in either direction are provided. The vertical milling head is of the most improved design, and is fitted with square gibbing and centrally located stops by which any tendency to tilt the head is entirely prevented. Fixtures may be mounted on the head instead of the vise shown.

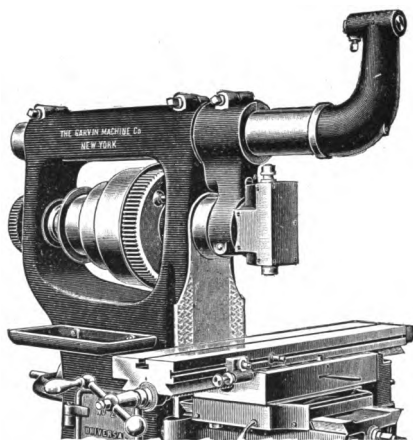
Both vertical and main slides are fitted with rack and pinion motion and long levers, which are adjustable in position.

Milling cuts at right angles to each other are easily made, and curved shapes may be milled by using a former.

The machine is also made without arm.

Dimensions of table inside oil pockets.....	5¼x20 in.
Vertical adjustment under spindle.....	17½ in.
Adjustment in line with spindle.....	4 in.
Vertical feed fixture.....	17½ in.
Length of feed.....	6¼ in.
Front spindle bearing.....	4½x2¾ in.
Arbor hole in spindle, B. & S. taper.....	No. 10
Largest diameter of cone.....	10⅝ in.
Number of steps on cone.....	4
Width of belt required.....	2¾ in.
Tight and loose pulleys on countershaft.....	12x3 in.
Speed of countershaft, revolutions per minute.....	120
Floor space required.....	37x52 in.
Domestic shipment, crated, weight.....	1,280 lbs.
Foreign shipment, tight boxed (40 c. f.).....	1,480 lbs.
Code word, as shown, with No. 3 vise.....	(Adage)
Code word, with No. 3 vise, without arm.....	(Acute)
Code word, without arm, vise, or vertical fixture.....	(Adapt)

For tools and attachments, see pages 54 to 66.



Vertical Spindle and Rack Cutting Attachment.

This is a very convenient attachment on our Plain and Universal Milling Machines, enabling the operator to quickly convert any of these machines into a Vertical Spindle Miller, or a Rack Cutter.

The Vertical Spindle Attachment consists of the swivelling cutter head and yoke, clamped on the arm and fastened to face of column. For rack cutting, a rack-holder or vise and an index dial are provided in addition to the cutter head and yoke.

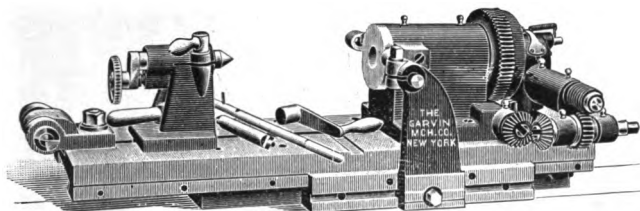
The Vertical Spindle Attachment is sold separately, and is a valuable tool on many special jobs, such as cutting spirals having a greater angle than forty-five degrees to the axis, profiling, etc.

The Cutter Spindle is driven by the Main Spindle through bevel gears, thoroughly protected from chips, and may be swiveled from a horizontal to a vertical position.

The index for rack cutting divides to thousandths of an inch.

Fitted to Machine.	Code Word for attachment complete. Vise and head.	Code Word for vertical attachment only.
No. 1 Universal Miller.....	(Azarole)	(Awake)
No. 2 " " ".....	(Azimuth)	(Award)
No. 3 " " ".....	(Azole)	(Awe)
No. 4 " " ".....	(Azote)	(Awkward)
No. 12 Plain " ".....	(Azotite)	(Awless)
No. 13 " " ".....	(Azure)	(Awry)
No. 14 " " ".....	(Azurite)	(Axilla)
No. 15 " " ".....	(Azygos)	(Axinite)
No. 16 " " ".....	(Azyme)	(Axiom)
No. 17 " " ".....	(Azymous)	(Axunge)

For milling cutters and collets, see pages 63 to 66.



Specification of Cam Cutting Fixture.

This fixture will cut all varieties of cylindrical and flat cams, is self-contained, and can be mounted on any milling machine, and adjustments of the milling machine table are available for regulating the position and depth of cut. The former pin can be set on any side as desired, and a weight passing over the pulley at the end of the miller table keeps the former against the pin. The head and tail stocks and driving gear bracket can be changed about, and also set at right angles to the table for cutting disk cams. Power and hand feed, as well as automatic trip, are provided in all positions, and the cam spindle is locked by the worm gear at all times. The head stock spindle has a long taper bearing, so that overhanging work may be handled without chatter; it is made hollow, and has a tapered end for the reception of arbors. Very large disk cams can be cut when set to overhang the edge of the slide. This fixture is available for all ordinary-sized jobs for which a former is used, and when there is any considerable amount of cam cutting to be done will save a great deal of time spent on temporary contrivances.

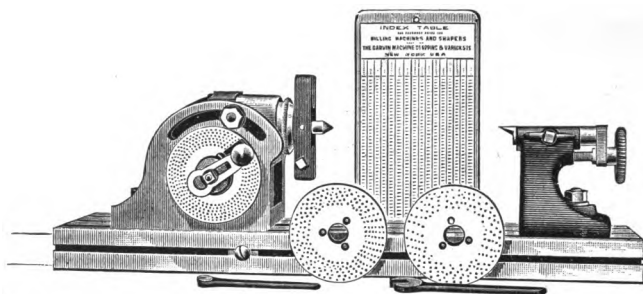
Net weight complete.....	260 lbs.
Swing of center over table.....	8 $\frac{1}{4}$ in.
Maximum distance between centers.....	12 in.
Code word, power feed.....	(Affy)
Code word for hand feed.....	(Afar)

Specification of Rotary Tables

Made in two sizes. No. 22 and No. 24. Have hand feed and throw out for quick return. For illustrations, see pages 34 and 36.

	No 22.	No 24.
Diameter of table.....	14 in.	18 in.
Height over all.....	3 13-16 in.	4 $\frac{1}{8}$ in.
Code word	Avolate	Avocado

For Milling Cutters, see pages 64 to 66.



Specification of Dividing Head and Tail Stock.

The above cut illustrates our No. 2 Dividing Head and Tail stock furnished with all our Universal Milling Machines. It is also recommended for use on plain milling machines, shapers, and planers, for accurately spacing gears, cutting mills of straight, conical, or irregular forms, gashing worm wheels, and fluting taps and reamers.

It is also compact and well made. The base of the head stock is long and has two holding-down bolts, insuring great rigidity, noticeable in cutting bevel gears and other overhanging work which can not be supported by the tail stock center.

The curved slots in the head frame, together with supplemental slots in the elevating head that carry the T head clamp bolts, allow the head to be depressed to 30 degrees below the horizontal line, and elevated to 5 degrees beyond a vertical, describing an arc of 125 degrees, determined by graduations on the head frame.

The spacing worm gear is made in halves and fitted with our patent compensating wedge, which gives a positive adjustment and effectually prevents the halves being forced out of position when set. This wedge can be reached from without through a hole in the rear of the head block, and the adjustments instantly made.

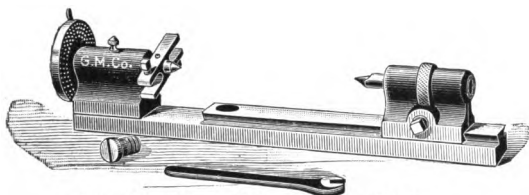
The spindle has a taper bearing in the head, a large taper hole through it, and the front end is threaded to receive a chuck.

Three index dials are furnished, dividing all numbers up to 50. and with the exception of a few prime numbers, all up to 360.

The No. 3, 4, and 5 Heads, in addition to the three small dials, have a dial, with four circles of holes, fitted directly on the front end of the spindle, and the dividing worm shaft is arranged to be readily withdrawn as a whole, so that the spindle can be indexed directly by the large dial, thus increasing its rapidity for plain, rapid work.

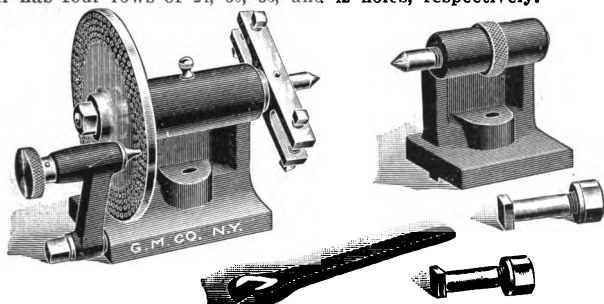
The tail stock is of very solid form. The center is fitted with milled hand-adjusting screw, which can be firmly and centrally bound its entire length, and has the point close to the top, so that work of small diameter can be milled.

No.	Actual swing.	Distance between centers on a 30-in. slide.	Size of hole in spindle.	Weight.	Code word, complete.
2	10 in.	12 $\frac{1}{4}$ in.	1 $\frac{1}{8}$ in.	55 lbs.	(Adieu)
3	12 $\frac{1}{4}$ "	9 "	1 $\frac{1}{4}$ "	106 "	(Adept)
4	14 $\frac{1}{2}$ "	8 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "	120 "	(Adjoin)
5	16 $\frac{1}{4}$ "	3 "	1 $\frac{1}{2}$ "	252 "	(Adjure)



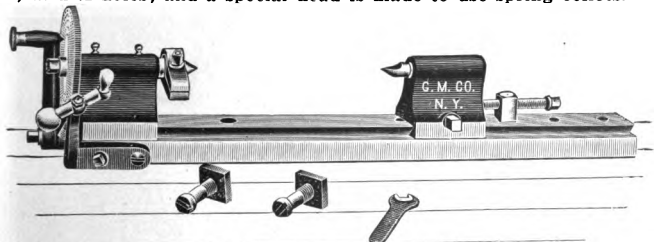
Specification of No. 1 Index Centers.

Swing of centers $2\frac{1}{4}$ in. Extreme length of bed $15\frac{1}{2}$ in. Index dial has four rows of 24, 30, 36, and 42 holes, respectively.



Specification of No. 2 Index Centers.

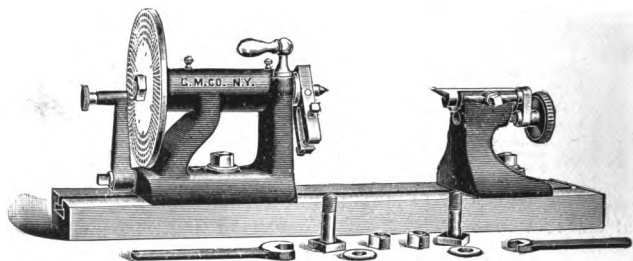
Swing of centers 6 in. Dial index, drilled in circles of 48, 56, 60, 66, and 72 holes; and a special head is made to use spring collets.



Specification of No. 3 Index Centers.

The dial is moved by a worm and has rows of 44, 48, 56, 72, 84, and 96 holes. Swing of centers $5\frac{3}{8}$ in. Length of bed $29\frac{3}{4}$ in.

	1	2	3
Center distance on slide.....	$15\frac{1}{2}$ in. - $7\frac{3}{4}$	30 in. - 21 in.	30 in. - 15 in.
Net weight complete	10 lbs.	12 lbs.	45 lbs.
Code word, as shown.....	(Against)	(Agate)	(Agent)
“ “ arranged for collets..		(Aged)	



Specification of No. 4 Index Centers.

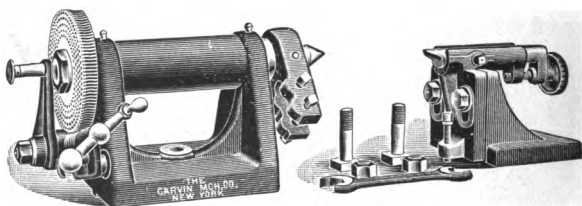
These centers swing 10 inches, and will, on a 29½-inch bed, take in 16 inches in length. The index plate has seven circles of holes numbering 46, 54, 60, 64, 66, and 84, respectively. The head and tail spindles can both be solidly bound for taking heavy cuts, relieving the index pin from all strain.

Distance between centers on a 30-inch slide.....16 in.

Net weight complete.....85 lbs.

Code word, as shown.....(**Agnostic**)

Code word, without base.....(**Agony**)



Specification of No. 5 Index Centers.

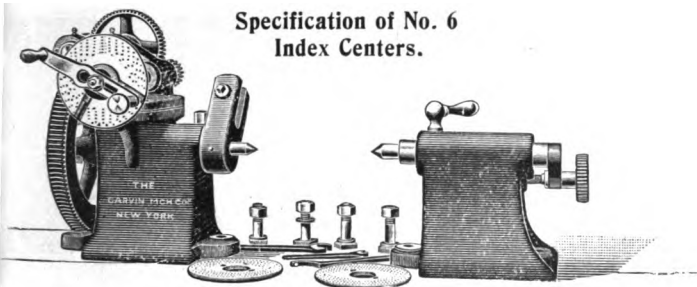
These centers will swing a diameter of 12 inches, are of substantial proportions and well made, and will hold rigidly any work that comes within their range. The head and tail stock are provided with steel tongue pieces to preserve the alignment. There is a worm and gear for turning and holding the head stock spindle, thus relieving the index pin and holes of all the strain, and the attendant wear and loss of accuracy. The worm gear has five accurately drilled circles of holes, as follows: 26, 44, 54, 64, and 70. The worm can be dropped out of gear when it is desired to turn the dial without it. The tail stock spindle has a vertical adjustment for handling taper work.

Distance between centers on a 36-inch slide.....16 in.

Net weight complete.....90 lbs.

Code word, complete, as shown.....(**Aground**)

Specification of No. 6 Index Centers.



These centers swing 16 inches, and are intended for heavy work of large diameter. The dividing gear is very large, insuring accuracy, and giving a solid support to the cut. The worm shaft is geared so that the work can be quickly rotated. These gears are reversible, enabling very large numbers to be divided with the same dials. Three index dials and an index table accompany the head. Distance between centers on a 36-inch slide.....11½ in.
Net weight complete.....215 lbs.
Code word, as shown.....(Agile)

Specification of No. 7 Index Centers.



These centers swing 8½ inches, and are suitable for simple gear cutting, notching, milling squares and hexagons, planing work on centers, etc. The spindles are large, and the design of the head and tail stocks is of the most solid character.

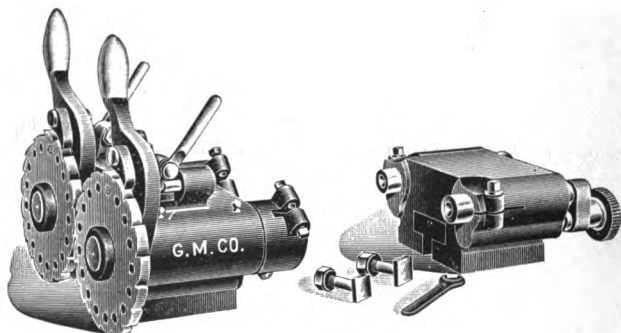
The head stock spindle carries a large dogging face plate and a dial plate with six rows of holes—72, 68, 66, 64, 60, 56—which cover a wide range. The spring lock bolt is fitted with a convenient lever handle. The tail spindle is moved by a square screw cut on the rear end, and is provided with a binder.

Extra dials with other index circles are furnished.

Distance between centers on a 36-inch slide.....20 in.
Net weight, complete.....90 lbs.
Code word, as shown..(Aghast) Code word for extra dial..(Agile)

Multiple Spindle Centers.

We make to order a variety of multiple spindle centers, from two to six spindle, both large and small, especially adapted for certain purposes, such as fluting taps and reamers, making milling cutters, hardware specialties, etc. We build them of various center distances, some being arranged for spiral fluting and others made to adjust for taper work. They are all designed to index simultaneously. These centers are for the most part set in large cast-iron pans, and arranged for pump connection to oil reservoir. They will be found to be most efficient in that so much more work can be turned out by the same machine and the same attendance as compared with single spindle center, and are therefore indispensable for manufacturing.

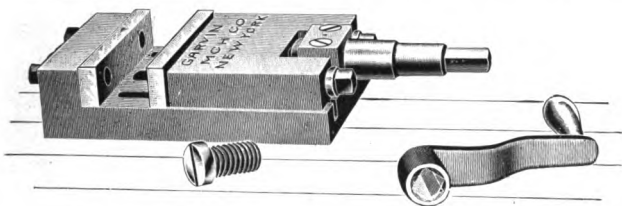


Double Spindle Sprocket Centers.

These centers are made in three sizes, and can be placed on any milling machine, and, being double, will turn out twice as much work as a single center. The work is indexed by a ratchet movement, and each spindle has its dial and lock-bolt, so that there is no back lash.

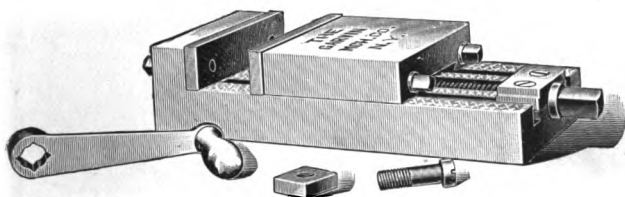
The index holes are large for a substantial lock-pin. The tail spindles are moved by coarse pitch screws and provided with clamp binders. The female centers in the spindles are hardened. The work is dogged by a stud on the arbor plate. The centers are furnished with two sets of dials. Other dials extra.

	No. 0.	No. 1.	No. 2.
Swing of center.	7½ in.	8½ in.	12 in.
Center distance of spindles	7½ "	8½ "	12 "
Distance between centers on a 36-in. slide.	14½ "	14½ "	18½ "
Net weight complete	180 lbs.	215 lbs.	250 lbs.
Code word, with two sets of dials	(Aquail)	(Agonist)	(Airy)
" " of extra set of dials -	(Agree)	(Agrestic)	(Ague)



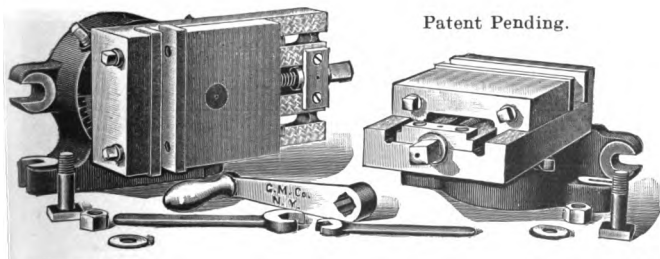
Milling Machine Vise Nos. 2 and 3.

This style of vise is made in two sizes and fitted with tool steel jaws and screws. The screw and cap bearing are covered by a sheet steel cover to prevent wear from dust and dirt.



Milling Machine Vise Nos. 4 and 5.

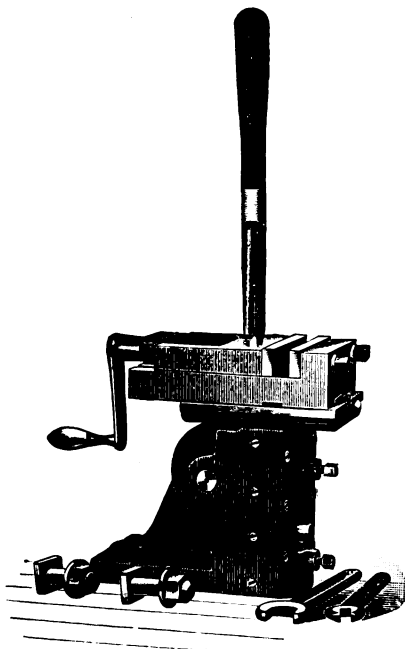
This design of vise has the advantage that for the space occupied a wider opening is obtained and greater strength than with the previous construction.



Swivel Milling Vise Nos. 2, 3, 4, 5, and 6.

This shows a regular vise, mounted on a graduated base, and held by a beveled friction disk and bound at any angle.

The base is provided with two clamping surfaces, so that the vise can be mounted horizontally or vertically, and clamped at any angle in either position.



Specification of Vertical Milling Attachment.

This attachment is the same as that used on our No. 3 Hand Milling Machine, and is a convenient tool for taking short, vertical cuts, and in combination with the table feed, horizontal and vertical cuts can be taken. The vertical slide is fitted with square gibbed surfaces and centrally located stops, which obviate any tendency to tilt the slide.

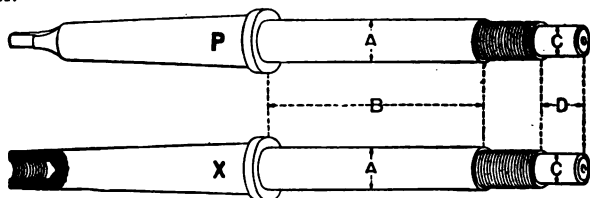
The slide has a movement of $1\frac{7}{8}$ in. by rack and pinion and long lever.

The top is arranged to take a vise, but any fixture may be mounted as well.

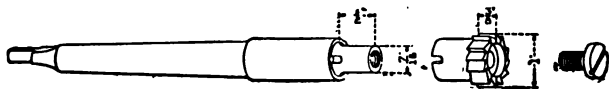
Net weight complete.....65 lbs.
 Code word, as shown with No. 3 vise.....(Advance)
 Code word, without No. 3 vise.....(Advent)

Arbors for Milling Machines.

We have in stock the arbors enumerated in the following list. They are made from selected stock, and are provided with hardened nuts and cast-iron collars, which are carefully faced and finished all over.



Machines.		A	B	C	D	Taper.
		INCH.	INCH.	INCH.	INCH.	NO.
No. 1 Univ. Milling Machine	X (Argot)	1	5 ⁷ / ₁₆	¾	1 ¼	10 B. & S.
" 2 " " "	X (Aroma)	1	7	¾	1 ¼	10
" 3 " " "	X (Argue)	1	8	¾	2 ¼	11
" 4 " " "	X (Aright)	1 ¼	12	1 ¼	3	12
" 11 Milling Machine	P (Armor)	5/8	3 ¾	¾	¾	....
" 12 " " "	P (Arnica)	1	4 ½	¾	1 ¼	....
" 13 " " "	X (Arouse)	1	5 ⁷ / ₁₆	¾	1 ¼	10 B. & S.
" 14 " " "	X (Arson)	1	7	¾	1 ¼	10
" 15 " " "	X (Arraign)	1	8	¾	1 ¼	10
" 16 " " "	X (Arrest)	1	8	¾	2 ¼	11
" 17 " " "	X (Arrow)	1 ¼	12	1 ¼	3	12
" 21 " " "	P (Array)	1	5 ¼	¾	1 ¼	....
" 22 Vert. Milling Machine	X (Arrested)	1	..	..	..	....
" 24 " " "	X (Artistic)	1	..	..	..	10 B. & S.
" 26 " " "	P (Arnicated)	1 ¼	..	..	..	12
" 1 Lincoln Pattern Miller	P (Artery)	1	7 ½	¾	1 ¼	....
" 2 " " "	P (Artful)	1	7 ½	¾	1 ¼	....
" 1 Hand Milling Machine	P (Ascend)	5/8	3 ¾	¾	¾	....
" 2 " " "	P (Ascribe)	5/8	3 ¾	¾	¾	....
" 3 " " "	P (Ashore)	1	5 ⁷ / ₁₆	¾	1 ¼	10 B. & S.
Cutter Grinder	(Aspect)	½	¾	..	..	....
Screw Slotter	(Asphalt)	5/8	¾	..	..	....
No. 1 Gear Cutter	(Assail)	½	1 ⁷ / ₁₆	..	..	....



Profiler Arbor and Cutter.

The above cut represents a neat design of arbor and cutter, which will be found more economical than the usual solid form.

Code word, as shown.....(Astern)
 Code word of extra Cutter.....(Asthma)



Specification of Milling Machine Collets.

These chucks are designed for holding straight shank mills. The collets are all interchangeable, and are made in eleven sizes, ranging from $\frac{1}{8}$ inch to $\frac{3}{4}$ inch by sixteenths. We furnish the chucks with shanks fitting the following machines:

		Taper	Code Word
No. 1 Universal Milling Machine	No. 10	B. & S.	(Apathy)
No. 2 Universal Milling Machine	" 10	"	(Apex)
No. 3 Universal Milling Machine	" 11	"	(Appall)
No. 4 Universal Milling Machine	" 12	"	(Appear)
No. 11 Milling Machine, 1 collet			(Apsis)
No. 12 Milling Machine, 1 collet			(Appease)
No. 13 Milling Machine	" 10	"	(Apple)
No. 14 Milling Machine	" 10	"	(Approve)
No. 15 Milling Machine	" 10	"	(Appoint)
No. 16 Milling Machine	" 11	"	(Apprize)
No. 17 Milling Machine	" 12	"	(Applaud)
No. 21 Milling Machine, one collet			(Aptly)
No. 22 Vertical Milling Machine, 1 collet			(Apostle)
No. 24 Vertical Milling Machine	" 10	"	(Appetizing)
No. 26 Vertical Milling Machine	" 12	"	(Appellate)
No. 1 Hand Milling Machine, 1 collet			(Appetite)
No. 2 Hand Milling Machine, 1 collet			(Appulse)
No. 3 Hand Milling Machine	" 10	"	(Apposite)
Profiling Machine with 1 collet			(Apricot)
Extra collets, each			(Apron)

These chucks are also made straight shank, for use in our screw machine turrets. See page 125.

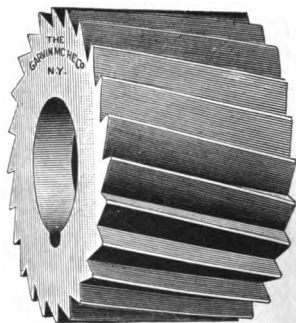
Milling Cutters, Straight or Spiral Teeth.

List of Plain Cutters.

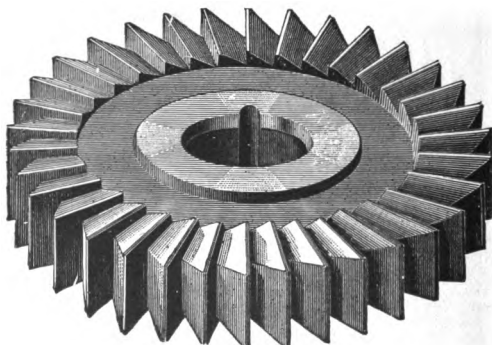
With 1-inch Standard Hole.

Width of Face	Diameter
$\frac{1}{8}$	$2\frac{1}{2}$
$\frac{3}{16}$	$2\frac{1}{2}$
$\frac{1}{4}$	$2\frac{1}{2}$
$\frac{5}{16}$	$2\frac{1}{2}$
$\frac{3}{8}$	$2\frac{1}{2}$
$\frac{7}{16}$	$2\frac{1}{2}$
$\frac{1}{2}$	$2\frac{3}{4}$
$\frac{3}{4}$	$2\frac{3}{4}$
$\frac{3}{4}$	$2\frac{1}{2}$
1	$2\frac{1}{2}$
$1\frac{1}{4}$	$2\frac{1}{2}$
$1\frac{1}{2}$	$2\frac{1}{2}$
$1\frac{3}{4}$	$2\frac{1}{2}$
2	$2\frac{1}{2}$
$2\frac{1}{4}$	$2\frac{1}{2}$
3	$2\frac{1}{2}$

Our stock of milling cutters includes the regular sizes given below. Straddle mills up to 4-in. diam. with 1-in. holes, angle cutters 50 to 80 degrees, and right- or left-hand shank mills. Orders for special cutters of any form, shape, or size can be promptly filled.



List of Straddle Mills.

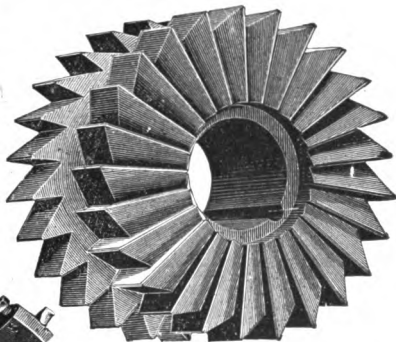


Diameter.....	$3\frac{1}{2}$ in.	4 in.	5 in.	6 in.
Width of face.....	$\frac{9}{16}$ "	$\frac{5}{8}$ "	$\frac{3}{4}$ "	$\frac{15}{16}$ "
Diameter of hole	1 "	1 "	1 "	$1\frac{1}{4}$ "
Price, each.....				

Double End Butt Mills.

We furnish this style of butt mill, 3 inches diameter by 2 inches face, to fit arbor for any of our milling machines. Both faces are cut left hand.

Arbor extra.

**Inserted Tooth Mills.**

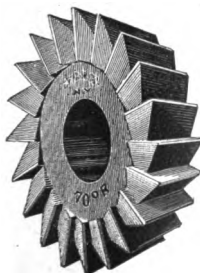
This cut illustrates our new Inserted Tooth Mill, which can be used either right or left hand, and is especially adapted for work on scale or hard castings and for straddle or face milling. The teeth are round tool steel, and can be taken out, sharpened, and replaced to a gauge. Size of the hole, 1¼ inches.

8-inch Mill,

10-inch Mill,

12-inch Mill.

We carry a full stock of annealed cutter forgings of thickness from ½ to 2 inches, and diameters between 3 and 6 inches. These will be furnished, to those who wish to work up their own stock, at reasonable prices to cover cost of importation.

Bevel Cutters.

Right-hand Cutter.

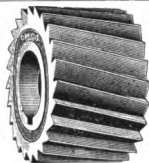
Spiral Mill Cutters.

We furnish these cutters of 50, 60, 70, or 80 degrees angle, right or left hand.

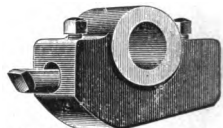
Cutters, 2¾-inch diameter, ½ inch thick, 1-inch hole, price, each,



Right-hand Cutter.

 $2\frac{1}{2} \times 2 \times 1$  $2\frac{3}{4} \times 1 \times 60^\circ$  $2\frac{3}{4} \times 1 \times 12^\circ \times 40^\circ$  $3 \times \frac{1}{8} \times 1$ 

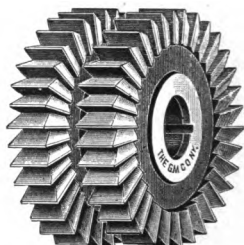
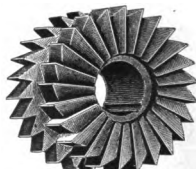
No. 7. COLLET.



SINGLE TOOTH CUTTER.



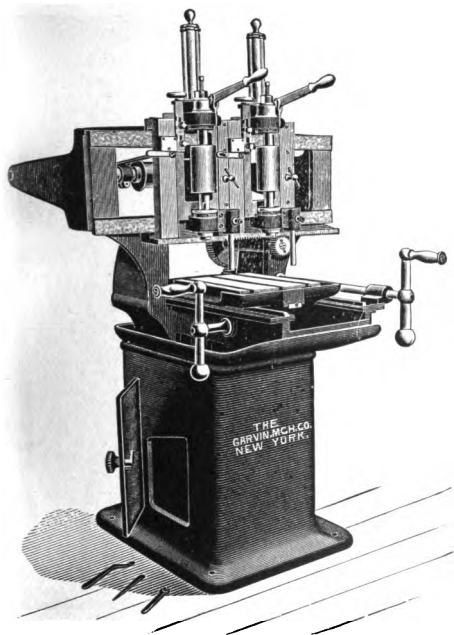
DRIFT.

No. 4. $\times \frac{5}{16}$ No. 7. $\times \frac{1}{2}$ No. 7. $\times \frac{3}{4}$ No. 7. $\times 1\frac{1}{4}$ No. 10. $\times 1$ 1PR. $4 \times \frac{1}{8} \times 1$ R. & L. 3×1 No. 10. $\times \frac{3}{4}$ - 20.
 $\left. \begin{array}{l} 1. R.H. \\ 1. L.H. \end{array} \right\} 1\frac{1}{4} \times \frac{3}{8} - 20 \times 60^\circ$

Set of Tools Fitting the Following Milling Machines.

Nos. 1 and 2 Universal, Nos. 13, 14, and 15 Plain and No. 3 Hand Millers. Code word, as shown.....(Assort)
 Socket to take in No. 7 Taper and fit Nos. 13, 14, and 15 Plain Millers, and No. 3 Hand Miller, extra. Code word.....(Assorted)

No. 1. Two-Spindle Profile Milling Machine.



This class of machine is universally used in gun factories and similar works, and produces accurate work and a fine finish. The use of two spindles permits a roughing cut to be taken with one spindle and the finishing cut with the other spindle without the necessity of adjusting the cutters every time, and thus secures absolute uniformity, and the time otherwise occupied in setting the cutters, is saved.

A separate and equally distant former pin is provided for each spindle.

The table and cross slide are moved by convenient ball handles, through the medium of rack and pinion, provision being made for taking up all back lash, which gives the requisite sensitiveness for following a former.

At a slight addition in cost, alter-

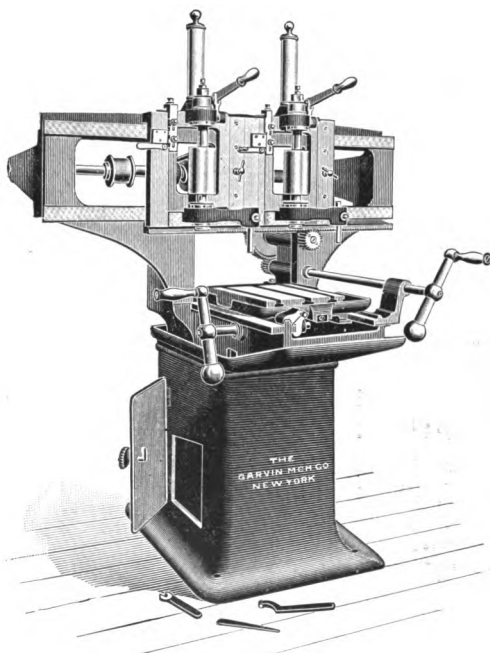
tations can be made in the patterns to suit any required height and width.

Photographs and data showing various changes furnished on application.

Working surface of table.....	15½x11¾ in.
Movement of table.....	22 in.
Movement of cross slide.....	20 in.
From table to cross slide.....	5½ in.
Diameter of spindles.....	1 5-16 in.
Spindle pin to former pin center.....	4 in.
Up and down movement.....	3½ in.
Friction pulleys on countershaft.....	14x3 and 8x3 in.
Speed of countershaft, revolutions per minute.....	14"=75 and 8"-150
Floor space required.....	52x49 in.
Domestic shipment, crated, weight.....	2,120 lbs.
Foreign shipment, tight boxed (78 c. f.).....	2,920 lbs.
Code word, complete, as shown.....	(Babbling)
Code word of oil pump and double piping.....	(Bycorner)
Code word of extra six-speed countershaft.....	(Bypast)

For tools and attachments, see pages 62 to 66.

No. 2. Two-Spindle Profile Milling Machine.



This machine has a larger range, and is somewhat heavier, than the No. 1, but is similar thereto in all respects.

Each spindle slide is balanced and has an independent vertical lever movement, and is fitted with an adjustable notched locking stop, with micrometer reading.

The spindles run in adjustable bronze boxes, and are driven by one continuous belt, with tightener.

These machines may be used for surfacing as well as forming work, the two spindles permitting roughing and finishing cuts to be taken without separate adjustments and insuring great uniformity.

The table is provided with 3 T slots, and the A pump and flex-

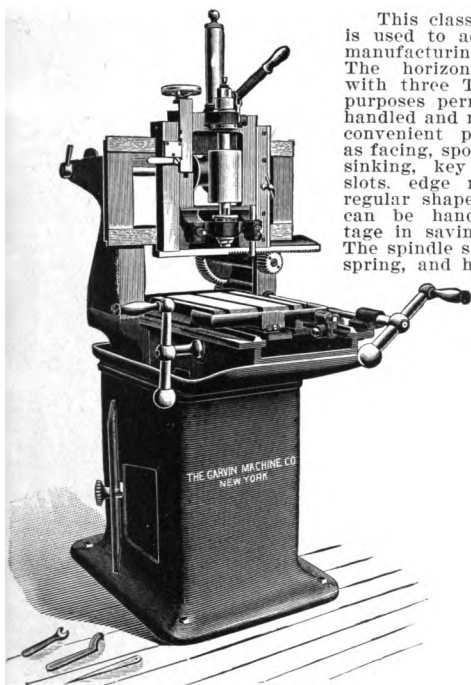
lubricant is led back to a reservoir in the base. Malleable piping to the spindles is provided extra.

Alterations in patterns to suit special conditions are readily made at slight expense.

Working surface of table.....	15½x11⅞ in.
Movement of table.....	22 in.
Movement of cross slide.....	28 in.
From table to cross slide.....	7½ in.
Diameter of spindles.....	1 5-16 in.
Spindle to former pin center.....	7 in.
Up and down movement.....	3¼ in.
Friction pulleys on countershaft.....	14x3 and 8x3 in.
Speed of countershaft, revolutions per minute.....	14"-75 and 8"-150
Floor space required.....	59x70 in.
Domestic shipment, crated, weight.....	2,250 lbs.
Foreign shipment, tight boxed (85 c. f.).....	3,250 lbs.
Code word, complete, as shown.....	(Badger)
Code word of oil pump and double piping.....	(Byname)
Code word of extra six-speed countershaft.....	(Byapell)

For tools and attachments, see pages 62 to 66.

No 3. Profile Milling Machine.



This class of milling machine is used to advantage on general manufacturing and jobbing work. The horizontal table arranged with three T slots for clamping purposes permits the work to be handled and machined in the most convenient position. Such work as facing, spotting off castings, die sinking, key seating, milling T slots, edge milling, profiling irregular shapes, cam-cutting, etc., can be handled to great advantage in saving of time and cost. The spindle slide is balanced by a spring, and has a micrometer ad-

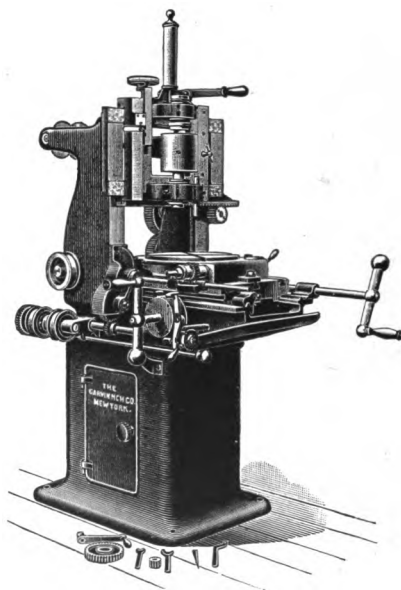
justment and notched locking stop. A former-pin hole is provided on each side for profiling. The spindle is driven by continuous belt with an improved tightener. The movements of the table and cross slide are by large ball handles conveniently placed, all cuts being governed by adjustable stops. Provision is made for leading the lubricant back to a reservoir formed in the base.

Floor space required 40x49 in.
 Working surface of table.....
 11 $\frac{1}{2}$ x15 $\frac{1}{2}$ in.
 Movement of table..... 18 in.
 Movement of cross slide.. 10 $\frac{1}{4}$ in.
 Distance from table to
 cross slide..... 5 $\frac{1}{2}$ in.
 Diameter of spindle.... 1 5-16 in.
 Up and down movement. 3 $\frac{1}{2}$ in.
 Spindle to former pin cen-
 ter..... 4 in.

Friction pulleys on coun-
 tershaft 14x3 and 8x3 in.
 Speed of countershaft on
 14-in. pulleys, rev. per
 minute 75
 Speed of countershaft on
 8-in. pulleys, revs. per
 minute 150
 Domestic shipment, crated,
 weight 1,875 lbs.
 Foreign shipment, tight
 boxed (62 c.f.) weight. 2,225 lbs.

Code word as shown..... (Babble)
 Code word of extra six-speed countershaft..... (Bacon)
 Code word of oil pump and piping..... (Back)

For tools and attachments, see pages 62 to 66.



No. 4 Profile Milling Machine.

Specification of No. 4 Profile Milling Machine.

This machine is somewhat larger and heavier than the No. 3, and is provided with power feed to the slide and a rotary table, also power driven.

The butt mills used in these machines are very efficient tools, and the power feed produces more uniform work and better finish than can be obtained by hand.

The slide is provided with three T slots, and affords a large surface for holding work and fixtures. Both hand and power feed, with automatic trip, are provided.

The rotary table is large and entirely protected, and provided with T slots for holding work, and is indispensable for milling curved edges and slots, finishing the inside edges of hand wheels, cam cutting, etc.

Hand and power feed with reverse are provided, and the table can be operated from either side. This attachment is readily mounted and removed without unscrewing any brackets or making connections.

The feed is driven from the countershaft and arranged with belt tightener, and four changes by gears are provided. The feed is thrown out and reversed by pushing a knob at the front.

The spindle is larger than the No. 3—carries a larger pulley and runs in bronze cap boxes. The driving belt is arranged with tightener by means of the idler pulleys on the back shaft.

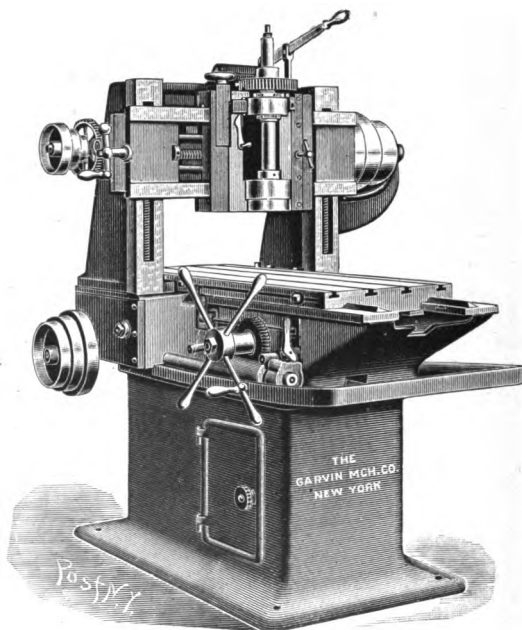
The spindle slide is balanced and provided with micrometer adjustment. At a slight addition in cost alterations can be made in the patterns for these machines, giving increased work clearance, both in height and width, thereby rendering them adaptable to most any range of work to be operated on.

Photographs and data showing various changes furnished on application.

A groove in the bed returns the lubricant to a reservoir in the base, from whence it can be readily pumped to supply the cutters.

Floor space required.....	45x51 in.
Size of sliding table.....	15 $\frac{3}{4}$ x24 in.
From sliding table to cross slide.....	10 $\frac{1}{2}$ in.
From circular table to cross slide.....	7 $\frac{3}{8}$ in.
Distance between uprights.....	16 in.
Movement of cross slide.....	12 $\frac{1}{2}$ in.
Diameter of spindle.....	1 11-16 in.
Up and down movement.....	3 in.
Length of feed of slide.....	24 in.
Diameter of circle that can be milled.....	24 in.
Diameter of circular table.....	14 $\frac{1}{8}$ in.
Distance between spindle and former pin.....	4 in.
Friction pulleys on countershaft.....	14x3 and 8x3 in.
Speed of countershaft on 14-in. pulleys, revolutions per minute.....	75
Speed of countershaft on 8-in. pulleys, revolutions per minute.....	150
Domestic shipment, crated, weight.....	1,950 lbs.
Foreign shipment, tight boxed, weight (100 c. f.).....	2,300 lbs.
Code word, as shown.....	(Baggage)
Code word, without circular attachment.....	(Bailiff)
Code word of oil pump and piping.....	(Bagnio)
Code word of extra six-speed countershaft.....	(Badge)

For tools and attachments, see pages 62 to 66.



No. 5 Traverse Head Milling Machine.

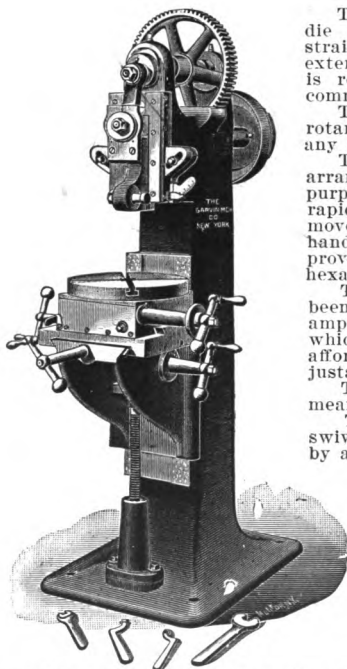
Specification of No. 5 Traverse Head Milling Machine.

In handling large work, the range of the regular profiler is often found to be inconveniently limited, and to meet the requirements of such work we have brought out a machine with an adjustable cross rail, similar to a planer, so that it is equally convenient for high and low work. A pump is provided and connected to a reservoir at the base, and the size and proportion of the machine are such as to adapt it for large and heavy work. There are twelve changes of feed which are reversible by lever, and provided with automatic trip. The table is fed by Seller's movement of oblique worm and rack. The cross slide has screw adjustment, with micrometer reading. The cross rail is worked from below by a handle conveniently placed. The spindle is driven by a large three-step cone, which, in conjunction with the countershaft, gives six spindle speeds, and is geared for ample power. The spindle slide has $3\frac{1}{2}$ inches direct vertical adjustment by lever, and is provided with our standard form of micrometer adjustment and notched locking stop. The spindle is taper, and runs in our standard spindle bearing, as shown on page 9. The Cutter Arbor is securely drawn to its taper seat or forced therefrom by means of a shouldered screw fixed at the top of the spindle. The upright is in one piece and has two cross ties, so that the utmost rigidity and freedom from vibration is secured. The rail has a wide bearing on the face and sides of the uprights, and can be bound at any point thereon. All working parts are accessible, and a large oil pan surrounds the machine.

Size of table.....	20x48 in.
Maximum clearance under rail.....	12 $\frac{3}{4}$ in.
Minimum clearance under rail.....	5 $\frac{1}{4}$ in.
Minimum distance—end of spindle to table.....	1 $\frac{3}{4}$ in.
Length of power feed.....	46 in.
Distance between uprights.....	25 in.
Traverse of cross slide.....	20 in.
Largest diameter of cone.....	12 in.
Change of speed by cone, 3, increased by countershaft to.....	6
Width of belt.....	3 $\frac{1}{2}$ in.
Front spindle bearing.....	2 $\frac{3}{4}$ x4 in.
Friction pulleys on countershaft.....	14x4 in.
Speed of countershaft, revolutions per minute.....	200-300
Floor space required.....	61x96 in.
Domestic shipment, crated, weight.....	4,600 lbs.
Foreign shipment, tight boxed (178 c. f.), weight.....	5,500 lbs.
Code word, as shown, with countershaft.....	(Bard)
Code word of oil pump and piping.....	(Bind)

For tools and attachments, see pages 62 to 66.

Specification of Die Slotting Machine.



This tool is well adapted to all die work, small key seating, both straight and taper; also internal or external gear patterns, where draft is required, and all that class of common slotting.

The two cross motions and the rotary table provide for following any outline.

The handle for the rotary table is arranged for using dials for dividing purposes, but for small divisions and rapid work it may be entirely removed, and the table revolved by hand, using the lock-pin device which provides twelve divisions for square, hexagon, octagon, duodecagon etc.

The stroke of the machine has been fixed at $2\frac{1}{2}$ inches, which is ample for this class of work for which the machine is intended, and affords greater strength than an adjustable pin.

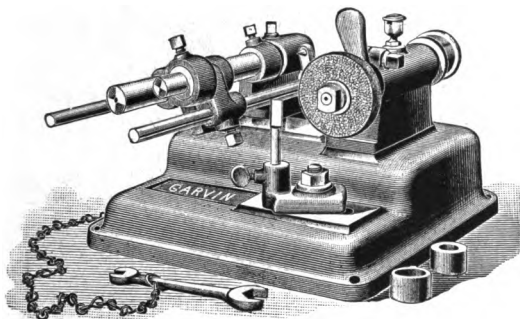
The speed can be changed by means of the cone pulley.

The slide for the ram can be swiveled 5 degrees either way and set by a graduated index, thereby insuring the same draft to every part of the die. The tool block is well adapted for holding special tools. It swivels in a center near its lower end, and at the upper end, carried in a yoke, are two hardened plugs which bear on a cam that is bushed into the lower end of the connecting rod and from it derives a partially rotary motion, thus locking the tool block on the down stroke and

causing the tool to clear on the up stroke.

Floor space required.....	28x44 in.	Front spindle bearing.....	$1\frac{1}{4} \times 3\frac{1}{2}$ in.
Diam. of circular table.....	12 in.	Size of tool used.....	$1 \times 1\frac{1}{2}$ in.
Vertical adjustment of table	15 in.	Stroke of slide.....	$2\frac{1}{2}$ in.
Adjustment in line with spindle	$7\frac{3}{8}$ in.	Column face to tool center.....	$9\frac{1}{4}$ in.
Adjustment across line of spindle	7 in.	Tight and loose pulleys on countershaft	10×3 in.
Largest diameter of cone.....	10 in.	Speed of countershaft....	225 rev.
Width of belt required....	$2\frac{1}{2}$ in.	Domestic shipment, crated, weight	1,012 lbs.
Proportion of back gearing.....	5 to 1	Foreign shipment, tight boxed (46 c. f.), weight.....	1,377 lbs.

Code word, as shown.....(Quietus)



Specification of No. 1 Cutter Grinder.

This small machine has ample capacity for all the ordinary sizes and varieties of milling cutters, while its compactness and small cost render it practicable to have several distributed around the shop in the vicinity of each group of milling machines, where they will prove a valuable addition to the plant, and soon pay for themselves in time saved. The machine is well made throughout, and will grind straight or spiral mills and shell reamers from 5 inches diameter and 4 inches face down to the smallest; side or face mills, bevel or angle cutters, from 8 inches diameter down; hand, machine, rose, and taper reamers, as large as $1\frac{1}{2}$ inches diameter, and 8 inches long; butt mills, either straight or taper; cutters for milling T slots and hollow mills, such as used on screw machines. Saws, cutters for gear teeth, drills, and all such tools as are generally ground by hand, can also be handled. Both spindle and arbor are of steel, hardened and ground, the latter to 1 inch standard size. All adjusting screws and nuts are case hardened, and fit wrench attached to the machine. The machine can be placed on the bench where most convenient, and driven by straight or quarter turned belt.

The spindle is provided with an eccentric adjustment for feeding the wheel against the work.

	BENCH	MOUNTED
Floor space required.....	20 x $10\frac{1}{2}$ in.	20 x 12 in
Width of spindle belt.....	1 in	1 in
Tight and loose pulleys on countershaft.	3 x $1\frac{1}{2}$ in.	3 x $1\frac{1}{2}$ in.
Speed of countershaft, revolutions per minute.	650 rev.	650 rev.
Net weight, complete.....	65 lbs	125 lbs.
Foreign shipment tight boxed, size.....	2 c. f.	5 c. f.
Foreign shipment tight boxed, weight.....	80 lbs	175 lbs.
Code word, with emery wheel and countershaft	(Ballad)	(Ballast)

Specification of No. 2 Cutter Grinder.

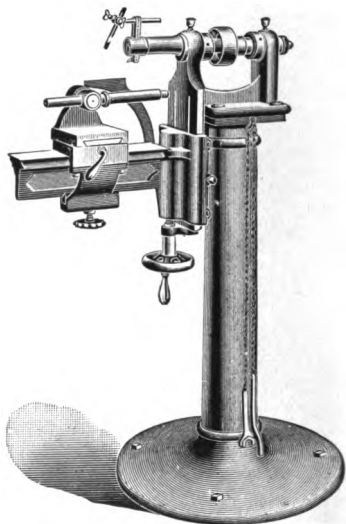
In the above Cutter Grinder will be found every desirable feature required for this class of tool. The knee is adjusted on the face of the column, and on the projecting horn thereof is fitted the sliding yoke carrying the mandrel head. This yoke is secured in place by a hand knob beneath.

The head holding the cutter mandrel, swivels, and is horizontally adjustable in all directions on the top of the yoke, being locked thereon by a cam binder. The mandrel itself is clamped in a bushing and can be set at any angle by means of the graduated arc. For grinding straight mills, the cutter is slid on the mandrel, and for angular cutters the yoke is moved in and out on the knee, but the same operation may be done in different ways. An adjustable figure guides the cutter, leaving plenty of space to handle the work. Large mills are ground on the sides by mounting them on the platform slide.

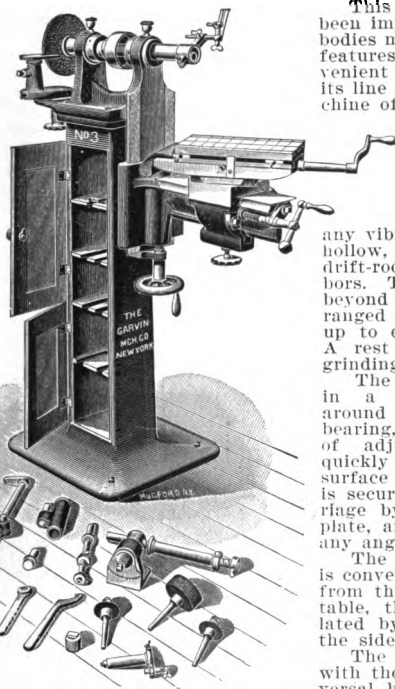
With this machine, all sizes and shapes of cutters can be handled, from $1\frac{1}{2}$ inches to $8\frac{1}{2}$ inches diameter, and face mills up to 12 inches diameter.

The spindle is nicely ground, and runs in long bearing adjustable for wear, and well protected from emery and dust. The front bearing extends clear out to the emery wheel to prevent vibration. Centers for grinding taper reamers, etc., are furnished extra. The top of the knee is shielded from emery by a plate steel guard.

Floor space required.....	36x23 in.
Width of spindle belt.....	1 $\frac{1}{4}$ in.
Tight and loose pulleys on countershaft.....	4 $\frac{1}{2}$ x2 in.
Speed of countershaft, revolutions per minute.....	400
Domestic shipment, crated, weight.....	375 lbs.
Foreign shipment, tight boxed (30 c. f.), weight.....	450 lbs.
Code word, as shown.....	(Ballet)
Extra for centers	(Balsam)
Extra for platform for face mills.....	(Bandit)
Extra for arbor and emery wheel.....	(Bangle)



Specification of No. 3 Universal Cutter and Tool Grinder.



This machine has recently been improved, and now embodies many new and valuable features, making it more convenient and better adapted to its line of work than any machine of the kind now on the market.

The front bearing is extended, forming an out-board support for the end of the spindle, thus preventing any vibration. The spindle is hollow, and is provided with a drift-rod for removing the arbors. The rear end extends beyond the bearing, and is arranged to carry emery wheels up to eight inches diameter. A rest is also provided for grinding small tools.

The guide finger is fixed in a yoke, which clamps around the end of the front bearing, giving a wide range of adjustment, and being quickly and easily set. The surface grinding attachment is secured to the sliding carriage by a dovetailed swivel plate, and is securely held at any angle by a cam-blinder.

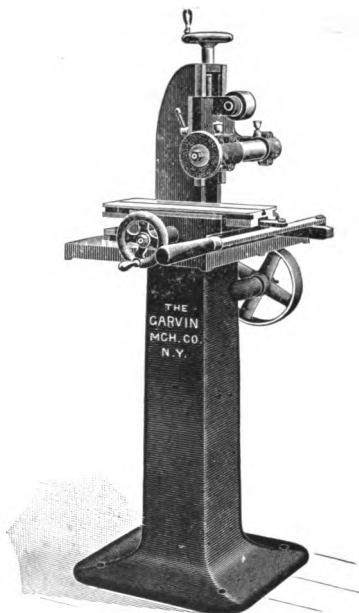
The actuating mechanism is conveniently operated either from the end or side of the table, the travel being regulated by adjustable stops on the side.

The machine is complete with the following: One universal head, centers for taps and reamers, one bevel cutter

stud, one end mill fixture, one $\frac{3}{4}$ -inch cutter arbor with sleeve, one $\frac{1}{2}$ -inch cutter arbor with sleeve, one face mill stud, three arbors for emery wheels, four emery wheels, one taper arbor socket, two fingers and wrenches. It will grind solid or shell reamers, taps and cutters of any shape up to 14-inch diameter by 6-inch face, and surface work 6x9 inches.

Write for special illustrated circular.

Floor space required.....	45x28 in.
Vertical adjustment of knee on column.....	6 $\frac{3}{4}$ in.
Adjustment of sliding table in line with spindle.....	9 $\frac{1}{2}$ in.
Travel of surfacing table.....	9 $\frac{1}{2}$ in.
Width of spindle belt.....	1 $\frac{1}{4}$ in.
Tight and loose pulleys on countershaft.....	4 $\frac{1}{2}$ x2 in.
Speed of countershaft, revolutions per minute.....	400
Domestic shipment, crated, weight.....	435 lbs.
Foreign shipment, tight boxed (33 c. f.) weight.....	525 lbs.
Code word, complete, as shown.....	(Banish)



Specification of Surface Grinder.

(Hand Feed.)

This is a very desirable tool, designed particularly for use in connection with punch presses for grinding and sharpening dies, punches, etc. It is also well adapted for general use as a small surface grinder. The slide is traversed by means of a hand lever, which makes a simple machine and secures quick work. The spindle has a vertical adjustment of 7 inches by a screw, providing ample room for running wheels of large diameter, and the bearings are provided with screw-top oil cups, thus effectually excluding all dust and emery. The plan of belting this machine puts a loop in the belt, which allows belting direct and dispenses with a tightener. The table has transverse screw adjustment of $6\frac{1}{2}$ inches, and is provided with a T slot for holding work. A surface 6x8 inches can be ground at one setting of the machine.

Floor space required.....	33x34 in.
Width of table.....	5 in.
Length of traverse.....	9 in.
Size of arbor.....	$\frac{1}{2}$ in.
Width of spindle belt.....	$1\frac{3}{4}$ in.
Tight and loose pulleys on countershaft.....	$4\frac{1}{2}$ x2 in.
Speed of countershaft, revolutions per minute.....	400
Domestic shipment, crated, weight.....	425 lbs.
Foreign shipment, tight boxed (11 c. f.), weight.....	480 lbs.
Code word, as shown, with emery wheel.....	(Banker)

Specification of Screw Machines.

The spindles are made large to secure the utmost limit in size of stock that can be passed through them, and the overhang of the chucks is kept down to a minimum to avoid chatter.

The bearings are solid bronze cap boxes, which give a perfect running bearing and afford every facility for taking up wear and maintaining the alignment.

The Friction Head in our machines is of a very superior design. The friction clutches are substantial, and readily adjusted, and will easily transmit all the belt can pull. Our style of head stock in which the back gearing is thrown in and out by means of friction clutches, is very desirable for slowing down, for threading, and also for obtaining proper speeds for abrupt changes in diameter work.

The wire feed collets on the smaller machines are of the push-out variety, with large heads and ample lengths which can be depended upon for holding the stock. In the No. 13 and No. 14 Machines, large pull-in collets arranged with interchangeable bushings are used.

The Wire Feed on the No. 00 and No. 1 is by weight, and on all the others by lever and ratchet movement.

The Cross Slides on the larger sizes are made screw-feed, giving power and steadiness to the cut.

The Stops on our cross slides are solid plug stops that can not be sprung, and, being capable of very fine adjustments, are very efficient.

Adjustment for Cross Slide Tools is obtained by spiral collars and spiral wedges resting on the same. The arrangement gives a fine adjustment that will remain where it is set when tools are removed for sharpening, and permits setting them close to the collet.

The Turret Slides and Bases have very large sliding surfaces to preserve alignment and reduce wear, the design of the locking mechanism being such as not to necessitate weakening underneath the turrets where the strength is needed.

The turret slides of the larger machines are mounted direct on the bed, which secures the utmost solidity and greatest swing for tools. The turrets are very carefully aligned; they have taper sleeve adjustments for wear, and the parts of the locking and indexing mechanisms are dropped forged, and hardened, and the lock pins and bushings are of tool steel, hardened and ground.

Special provision is made for checking the momentum of the turret and relieving the locking mechanisms of undue wear.

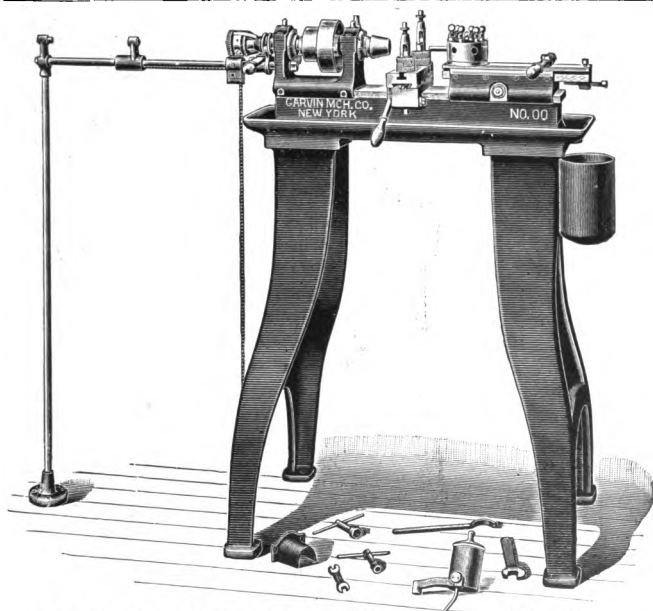
Turret Binders.—The turrets of the larger sizes are provided with central binders, the levers of which do not rotate with the turrets, but remain always at hand in the same position.

The power feed mechanism on the larger machines is placed in front, and positively driven with chain and sprockets, with tightener, instead of the usual short leather belt, which, when saturated with oil, slips on the feed pulley and lowers the producing capacity of the machine; it is very simple and readily manipulated, the parts being perfectly protected from dirt.

The beds are closed on the bottom as well as on the top, making a regular box, thereby obtaining the utmost stiffness.

Spring Leg.—To avoid warping the bed and thus throwing the machine out of line when bolting down, we have made one of the short legs in the oil pan a spring leg which will give way and relieve the bed of all stress when bolting down, but when the machine is secured, this spring leg can be made perfectly rigid by pushing in two taper pins.

The Oil Pans are especially large and deep to hold a great quantity of chips, which accumulate when forming so many large pieces from the bar with one broad cut. Oil reservoirs under the pans are provided with double strainers, and a rotary pump can be piped to these and the oil forced to the tools through a flexible tube, which is very durable and quickly adjusted.



Specification of No. 00 Screw Machine with Wire Feed.

This size will take stock up to $\frac{1}{4}$ -inch diameter, and is suitable for the smallest size of rod work. An endless variety of screws, studs, and pins, such as used in watch cases, clocks, electric light fittings, etc., can be made from steel or brass on this machine. The lightness of the working parts gives the requisite sensitiveness for small tools, and the low height, combined with the small compass, make it a convenient tool for rapid work and large production.

Regular collets in stock for this machine are 1-16-in. to $\frac{1}{4}$ -in., varying by thirty-seconds. Other sizes, special price.

For general description, see page 79.

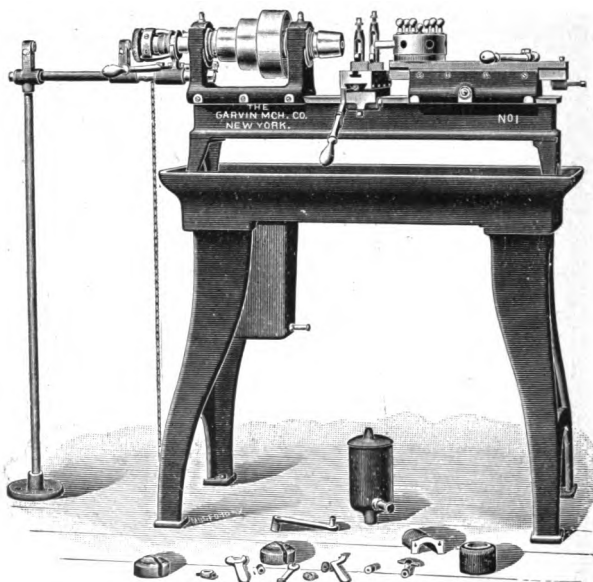
Floor space required... 30x17 in.
 Largest diameter of cone... 4 in.
 Width of belt required... $1\frac{1}{4}$ in.
 Diameter of spindle... $1\frac{1}{8}$ in.
 Capacity with wire feed... $\frac{1}{4}$ in.
 Capacity without wire feed... 9-16 in.
 Swing over bed... 6 in.
 Diameter of turret... $2\frac{7}{8}$ in.
 Number of holes in turret... 6

Diameter of holes in turret... 7-16 in.
 Length that can be milled... 2 in.
 Friction pulleys on countershaft... 6x2 in.
 Speed of countershaft... 400 rev.
 Domestic shipment, crated, weight... 240 lbs.
 Foreign shipment, tight boxed, (9 c. f.) weight... 390 lbs.

Code Word.

Machine with Wire Feed, as shown... (Banjo)
 Machine without Wire Feed... (Banquet)

For tools and attachments, see pages 117 to 125.



No. 1 and No. 11 Screw Machine with Wire Feed.

No. 11 Screw Machine is the No. 1 Machine, with increased spindle capacity.

	No. 1.	No. 11.
Machine with Wire Feed, as shown.....	Barber	Bless
Machine without Wire Feed.....	Barley	Blab
Machine with Automatic Chuck.....	Befriend	Begot
Three-speed Countershaft (for any above machines), use extra word.....	Bonny	Bonny
Oil Pump and Piping (for any above machines) use extra word.....	Bedim	Bedim
Forming Cross Slide, hand feed (for any above machines), use extra word.....	Bloat	Bloat

Capstan Feed for turret can be made to order. When wanted, add word "Capstan" to regular code word.

(See page 94.)

Specification of No. 1 and No. 11 Screw Machines.

This size of screw machine is well adapted for making the common sizes of small screws, pins, knobs, etc., used on typewriters, sewing machines, small manufactured articles, etc.

The machine is built to stand continual rapid work, and has every desirable feature that experience and skill could suggest, and has thus far stood the severest tests without interruption of any kind. The movement and indexing of the turret is light and uniform, and the spindle spring collets are well proportioned, very carefully manufactured, and will be found entirely satisfactory.

Regular collets in stock for No. 1 Machine, are $\frac{1}{8}$ to $\frac{5}{8}$ inch, varying by thirty-seconds.

Regular collets in stock for No. 11 Machine are $\frac{1}{4}$ to $\frac{7}{8}$ inch, varying by thirty-seconds.

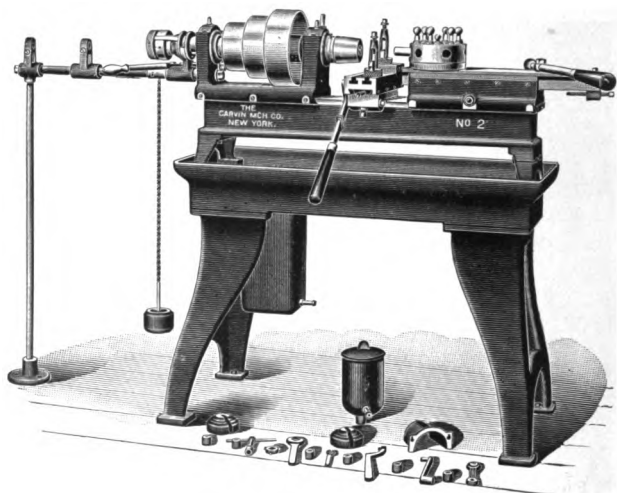
Other sizes, special price.

For general description, see page 79.

	No. 1.	No. 11.
Floor space required.....	42x22 in.	42x22 in.
Largest diameter of cone.....	6 in.	6 in.
Width of belt required.....	2 in.	2 in.
Capacity of wire feed.....	$\frac{5}{8}$ in.	$\frac{1}{2}$ in.
Capacity without wire feed.....	13-16 in.	11 $\frac{1}{4}$ in.
Swing over bed.....	9 in.	9 in.
Diameter of turret.....	4 $\frac{5}{8}$ in.	4 $\frac{5}{8}$ in.
Number of holes in turret.....	6	6
Diameter of holes in turret.....	11-16 in.	11-16 in.
Length that can be milled.....	3 in.	3 in.
Friction pulleys on countershaft.....	8x3 in.	8x3 in.
Speed of countershaft, revolutions per minute.....	300	300
Domestic shipment, crated, weight.....	500 lbs.	500 lbs.
Foreign shipment, tight boxed (23 c. f.), weight.....	700 lbs.	700 lbs.

For tools and attachments, see pages 117 to 125.

For Special Set of Tools for this machine, see page 126.



No. 2 and No. 12 Screw Machine with Wire Feed.

No. 12 Machine is the No. 2 machine with increased spindle capacity.

No. 12 Machine has Pilot Wheel turret.

	Code Word.	
	No. 2	No. 12.
Machine with Wire Feed, as shown.....	Bang	Blew
Machine without Wire Feed.....	Barn	Black
Machine with automatic chuck.....	Bearn	Bedust
Forming cross slide, hand feed (for any above machines), use extra word.....	Block	Block
Three-speed Countershaft (for any above machines), use extra word.....	Burax	Borax
Oil Pump and Piping (for any above machines), use extra word.....	Befit	Befit

(See page 94.)

Specification of No. 2 and No. 12 Screw Machine.

This machine is the size best adapted for general screw and stud work and ordinary machine shop use. Bicycle parts of the smaller variety, as pedal barrels, axle cones, knurled nuts, etc., are handled very readily in this machine.

No. 2 Machine is made with lever turret feed, and No. 12 Machine is made with pilot wheel feed.

Regular collets in stock for No. 2 Machine are: $\frac{1}{4}$ in. to $\frac{7}{8}$ in., varying by thirty-seconds.

Regular collets in stock for No. 12 Machine are: $\frac{1}{2}$ to $1\frac{1}{4}$ in., varying by sixteenths.

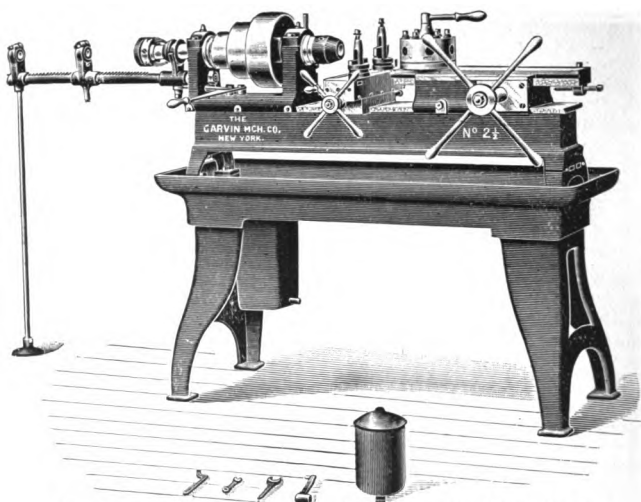
Other sizes, special prices.

For general description, see page 79.

	No. 2.	No. 12.
Floor space required.....	56x26 in.	56x26 in.
Largest diameter of cone.....	8½ in.	8½ in.
Width of belt required.....	2½ in.	2½ in.
Capacity of wire feed.....	$\frac{7}{8}$ in.	1¼ in.
Capacity without wire feed.....	1¼ in.	1 9-16 in.
Swing over bed.....	10½ in.	10½ in.
Diameter of turret.....	6½ in.	6½ in.
Number of holes in turret.....	6	6
Diameter of holes in turret.....	1 in.	1 in.
Length that can be milled.....	6 in.	6 in.
Friction pulleys on countershaft.....	10x3 in.	10x3 in.
Speed of countershaft, revolutions per minute.....	260	260
Domestic shipment, crated, weight.....	925 lbs.	925 lbs.
Foreign shipment, tight boxed (33 c. f.), weight....	1,200 lbs.	1,200 lbs.

For tools and attachments, see pages 117 to 125.

For Special Set of Tools for this machine, see page 126.



No. 2 $\frac{1}{2}$ and No. 12 $\frac{1}{2}$ Screw Machine with Wire Feed.

No. 12 $\frac{1}{2}$ Machine is the No. 2 $\frac{1}{2}$ Machine with increased spindle capacity.

	No. 2 $\frac{1}{2}$	No. 12 $\frac{1}{2}$
Machine with wire feed, but no gearing or turret feed, as shown.....	Barack	Blind
Machine with wire feed, with power feed to turret, but no gearing.....	Bonify	Bonetta
Machine with wire feed, with geared friction head, but no turret feed.....	Byzantian	Byzant
Machine with wire feed, with geared friction head and power feed to turret.....	Byssus	Byssine
Machine without wire feed, but no gearing or turret feed.....	Baron	Blade
Machine without wire feed, with power feed to turret, but no gearing.....	Bateful	Bigamist
Machine without wire feed, with geared friction head, but no turret feed.....	Bounce	Bouncer
Machine without wire feed, with geared friction head and power feed to turret.....	Boulevard	Botanist
Machine with automatic chuck, but no gearing or turret feed.....	Bigboned	Bigness
Machine with automatic chuck, with power feed to turret, but no gearing.....	Bigswoln	Bllander
Machine with automatic chuck, with geared friction head, but no turret feed.....	Bilateral	Bilberry
Machine with automatic chuck, with geared friction head and power feed to turret..	Bilbo	Billious
Forming cross slide, Hand Feed (for any above machines), use extra word.....	Blood	Blood

(Continued on next page.)

	No. 2½.	No. 12½.
Forming cross slide, Power Feed (for any these machines), use extra word.....	Blot	Blot
Three-speed Countershaft (for any these machines), use extra word.....	Bosky	Bosky
Oil Pump and Piping (for any these machines), use extra word.....	Beset	Beset

Specification of No. 2½ and No. 12½ Screw Machines.

This machine is made with a plain cone on the spindle, also back-gearred friction head, with or without wire feed, and with power feed to turret, or any and all combinations of these. The form of geared head in which the back gearing is thrown in by friction clutches on the spindle is the best and most desirable to give the changes in the speed necessary for drilling and then running on dies, etc., and it should be observed that the friction head and power feed to the turret slide should go together, as they supplement each other on most work. The size of this machine is well adapted for the general run of bicycle parts, has screw feed to cross slide, which imparts the most steady motion for operations required on forgings, and, with solid plug stops, assures uniform accuracy.

Regular collets in stock for No. 2½ machine, ½ in. to 1¼ ins., varying by sixteenths.

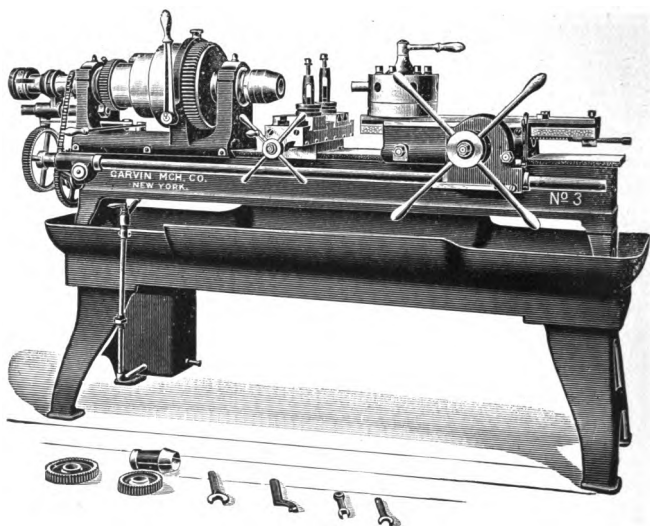
Regular collets in stock for No. 12½ Machine, ¾ to 1 15-16 ins., varying by sixteenths.

Other sizes, special price.

For general description, see page 79.

	No. 2½.	No. 12½.
Floor space required.....	72x26 in.	72x26 in.
Largest diameter of cone.....	11 in.	11 in.
Width of belt required for plain cone.....	3½ in.	3½ in.
Width of belt required for geared cone.....	2¾ in.	2¾ in.
Swing over bed.....	14 in.	14 in.
Capacity of spindle with wire feed.....	1¼ in.	1 15-16 in.
Capacity of spindle without wire feed.....	1 9-16 in.	2 5-16 in.
Diameter of turret.....	7⅞ in.	7⅞ in.
Number of holes in turret.....	6	6
Diameter of holes in turret.....	1¼ in.	1¼ in.
Center of holes to turret slide.....	2½ in.	2½ in.
Length that can be milled.....	8½ in.	8½ in.
Length of bed.....	54 in.	54 in.
Friction pulleys on countershaft.....	12x4 in.	12x4 in.
Speed of countershaft, revolutions per minute.....	220	220
Domestic shipment, crated, weight.....	1,575 lbs.	1,575 lbs.
Foreign shipment, tight boxed (65 c. f.), weight.....	1,850 lbs.	1,850 lbs.

For tools and attachments, see pages 117 to 125.



No. 3 Screw Machine with Automatic Chuck, Geared Friction Head, and Power Feed to Turret.

	Code Word.
Machine with wire feed, but no gearing or turret feed	(Barricade)
Machine with wire feed, with power feed to turret, but no gearing	(Boniform)
Machine with wire feed, with geared friction head, but no turret feed.....	(Ryzantine)
Machine with wire feed, with geared friction head and power feed to turret.....	(Byssolite)
Machine without wire feed, but no gearing or turret feed	(Barrister)
Machine without wire feed, with power feed to turret, but no gearing.....	(Billion)
Machine without wire feed, with geared friction head, but no turret feed.....	(Bouncing)
Machine without wire feed, with geared friction head and power feed to turret.....	(Botany)
Machine with automatic chuck, but no gearing or turret feed,	(Bilobed)
Machine with automatic chuck, with power feed to turret but no gearing.....	(Bliva)
Machine with automatic chuck, with geared friction head, but no turret feed.....	(Bowsprit)
Machine with automatic chuck, with geared friction head and power feed to turret (as shown).....	(Book)

(Continued on next page.)

Forming Cross Slide, Hand Feed (for any No. 3 machine), use extra word.....	(Bimana)
Forming Cross Slide, Power Feed (for any No. 3 machine), use extra word.....	(Bimedial)
Three-speed Countershaft (for any No. 3 machine), use extra word.....	(Botch)
Oil Pump and Piping (for any No. 3 machine), use extra word	(Bestir)

Specification of No. 3 Screw Machine.

This is a powerful tool of large capacity, and adapted for handling the general run of castings which require to be bored and threaded, etc., and which are therefore handled to advantage in a screw machine. The machine is built with plain cone, friction head, back gear, and with or without wire feed and power feed, and in all combinations of these, but generally the friction head and power feed are combined.

The cross slide is moved by a screw, and carries two smaller slides, which form an independent side adjustment for each tool.

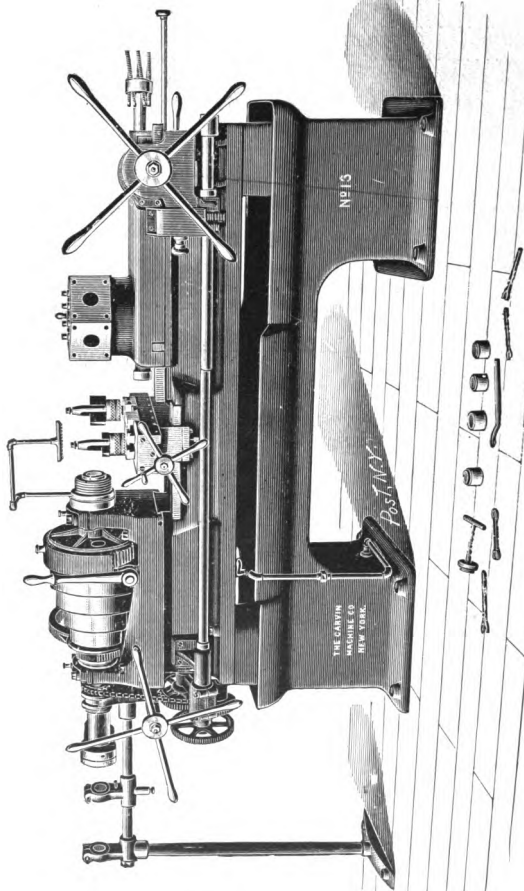
The turret has ample proportions, and will swing large tools over the top of the slide.

Regular collets in stock for this machine $\frac{3}{4}$ in. to 1 15-16 ins., varying by sixteenths.

For general description, see page 79.

Floor space required.....	96x33 in.
Largest diameter of cone.....	12 in.
Width of belt required.....	3 $\frac{1}{2}$ in.
Diameter of spindle.....	3 $\frac{1}{4}$ in.
Capacity of spindle with wire feed.....	1 15-16 in.
Capacity of spindle without wire feed.....	2 15-16 in.
Swing over bed.....	17 in.
Length of bed	73 in.
Diameter of turret.....	9 $\frac{1}{8}$ in.
Number of holes in turret.....	6
Diameter of holes in turret.....	1 $\frac{1}{4}$ in.
Length that can be milled.....	9 $\frac{1}{4}$ in.
Friction pulleys on countershaft.....	14x4 in.
Speed of countershaft, revolutions per minute.....	180
Domestic shipment, crated, weight.....	2,500 lbs.
Foreign shipment, tight boxed (130 c. f.) weight.....	3,200 lbs.

For tools and attachments, see pages 117 to 125.



No. 13 Screw Machine with Wire Feed, Geared Friction Head and Power Feed to Turret.

Machine with Wire Feed, with Geared Friction Head and Power Feed to Turret, as shown. Code word
 Machine without Wire Feed, with Plain Back Gears and Power Feed to Turret. Bimensal
 Machine without Wire Feed, with Geared Friction Head and Power Feed to Turret. Binary
 Machine with Automatic Chuck, with Geared Friction Head and Power Feed to Turret. Binubber
 Forming Cross Slide, Power Feed (special) for any above machines. Binate

Note.—Oil Pump and Piping and Three-speed Countershaft are regularly furnished with all of the above machines.

Specification of No. 13 Screw Machine.

This size machine is adapted to the want of manufacturers of electric motors, motor vehicles, bicycles, valves, and general manufacturing, as the large spindle capacity and great swing make it equally well adapted for forming pieces from the bar or working up castings. The head stock is specially heavy, and is fitted with a large four-step cone and friction back gear, in the ratio of 8 to 1. The machines are built with friction head and power feed—with or without wire feed. The wire feed collet is draw-back without any overhanging nose piece.

The bed is box form with gap, and sets on cabinet oil pan fitted with reservoir and double strainer. The gap gives increased swing and opening for chips and maintains a clear way for the turret slide. The turret has large hexagonal faces for tools, large swing, and 2-in. holes clear through for the passage of long work. The turret is locked and unlocked, indexed and bound, all automatically, and has an independent trip and stops for each tool. A special stop is provided, which prevents damage to the lock bolt, due to the momentum of the turret in indexing.

The turret slide fits directly on the bed, has a long bearing and taper gib, works lightly, and can be set to operate the turret at any point along the bed. The feed is positive, with eight gear changes and a slip friction to prevent smash-ups. A special arrangement is provided on the turret slide for changing instantly from slow to fast feeds, as needed for finishing cuts, reaming, etc.

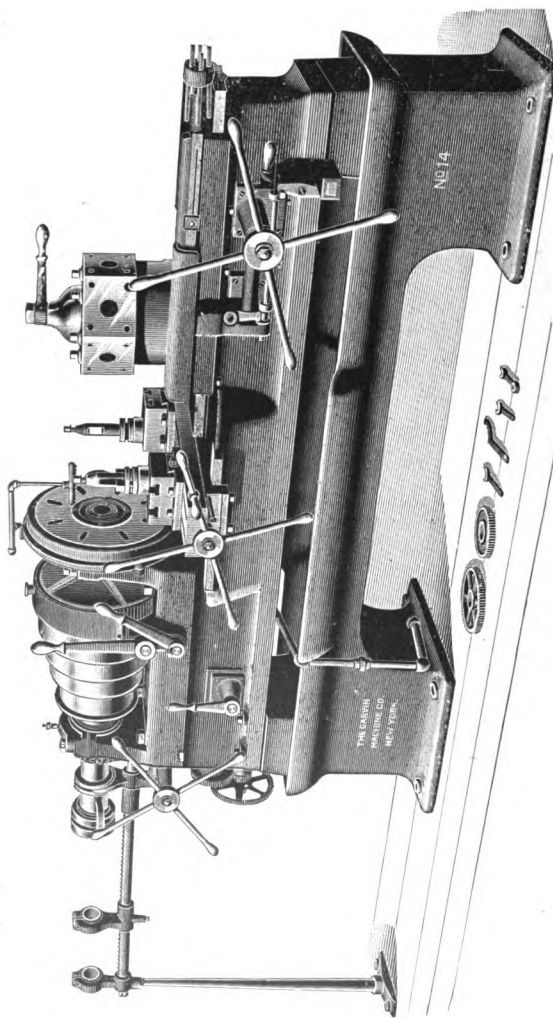
The cross slide sets over the gap, giving large swing over it. The slide is screw feed with plug stops, entirely protected. Large tool posts are provided, and cross adjusting slides for convenient setting of tools. A three-speed countershaft is furnished, giving 16 speeds and reverse.

Regular bushings in stock for this machine, all sizes, varying by sixteenths.

For general description, see page 79.

Capacity with wire feed.....	1	15-16 in.
Capacity without wire feed.....	2	5-16 in.
Width of belt required.....	3	in.
Largest diameter of cone.....	13½	in.
Back gear.....	8 to 1	
Swing over gap.....	22	in.
Length of bed.....	80	in.
Diameter of turret.....	11	in.
Number of holes in turret.....	6	
Diameter of holes in turret.....	2	in.
Center of holes to turret slide.....	5½	in.
Feed of turret slide.....	20	in.
Friction pulleys on countershaft.....	16x4	in.
Speed of countershaft, revolutions per minute.....	120-180	
Floor space required.....	36x100	in.
Domestic shipment, crated, weight.....	4,096	lbs.
Foreign shipment, tight boxed (164 c. f.).....	5,325	lbs.

For tools and attachments, see pages 117 to 125.



No. 14 Screw Machine with Wire Feed, Geared Friction Head, Geared Face Plate, and Power Feed to Turret.

Machine with Wire Feed, Geared Friction Head and Power Feed to Turret, as shown..... Binomial
 Machine without Wire Feed, with Plain Back Gears and Power Feed to Turret..... Binoxid
 Machine without Wire Feed, with Geared Friction Head and Power Feed to Turret..... Bazan
 Machine with Automatic Chuck, with Geared Friction Head and Power Feed to Turret. Binocular
 Note.—Oil Pump and Piping and Three-speed Countershaft are regularly furnished with all of the
 above machines. (See page 93)

Specification of No. 14 Screw Machine.

This is a heavy tool of large capacity, well adapted for the manufacture of the bearings, gears, and engine parts of motor vehicles, electric motors, and general manufacturing operations on castings and forming from the bar. The spindle is very large, has large hole through it, and for the wire feed machine is fitted with a drawback collet, which does not overhang and is arranged to bush down for small diameters.

The head stock is massive and arranged for a large four-step cone and friction back gear 8 to 1, and with face plate drive 14 to 1. This face plate gives a powerful, steady drive for large work, and is provided with bolt slots, and lathe chucks can be attached directly thereto. The bed is box form with gap, and sets on cabinet oil pan fitted with reservoir and double strainer. The turret slide capstan is mounted at a fixed point on the bed. This gap greatly increases the capacity of the machine, for which there is ample power, and maintains a clear bed for the turret slide. The turret has large hexagonal faces, large swing for tools, and $2\frac{1}{2}$ -in. holes clear through. The turret is not indexed automatically, but the binding lever works the lock bolt and forces the bolt to its seat before the turret is bound. Independent trip and stop is provided for each tool.

The power feed is positive, with gear changes and slip friction, and a separate set of feeds is provided to give accurately pitched lead for screw cutting. Changes can be made at once from the regular feed to screw cutting by throwing a lever at the head stock. An index board is furnished. The turret slide is mounted directly on the bed, moves easily, and has a long bearing, and is fitted with a taper gib. The cross slide sets on the gap and swings 18 inches over it. The tool post blocks are adjustable lengthways on the main slide, and are also provided with cross adjusting slides, which are convenient in setting tools and can be used for cross feed also.

Regular bushings in stock for this machine, all sizes, varying by sixteenths.

For general description, see page 79.

Capacity with wire feed.....	$2\frac{1}{2}$ in.
Capacity without wire feed.....	$3\frac{1}{8}$ in.
Width of belt required.....	$3\frac{1}{2}$ in.
Largest diameter of cone.....	16 in.
Back gear	8 and 14 to 1
Swing over gap.....	30 in.
Length of bed.....	90 in.
Diameter of turret.....	$12\frac{1}{2}$ in.
Number of holes in turret.....	6
Diameter of holes in turret.....	$2\frac{1}{2}$ in.
Center of holes to turret slide.....	$8\frac{1}{4}$ in.
Feed of turret slide.....	26 in.
Friction pulleys on countershaft.....	16x4 in.
Speed of countershaft, revolutions per minute.....	100-165
Floor space required.....	120x45 in.
Domestic shipment, crated, weight.....	5,100 lbs.
Foreign shipment, tight boxed (170 c. f.).....	6,000 lbs.

For tools and attachments, see pages 117 to 125.

For Style of PUSH-OUT WIRE FEED,	
see page	84
“ “ “ DRAW-BACK WIRE FEED,	
see page	90
“ “ “ PUSH-OUT AUTOMATIC	
CHUCK, see page	96
“ “ “ DRAW-BACK AUTOMATIC	
CHUCK, see page	98
“ “ “ GEARED FRICTION HEAD,	
see page	88
“ “ “ POWER FEED TO TURRET,	
see page	88
“ “ “ VERTICAL FORMING AT-	
TACHMENT, see page	98
“ “ “ TAPER TURNING ATTACH-	
MENT, see page	117
“ “ “ FORMING CROSS SLIDE,	
see page	107

Specification of Monitor or Chucking Lathes.

For brass working, chucking work, and general handling of castings.

We build a complete line of machines in which the requirements of forming from the bar and convenient working up of castings have been carefully studied. These machines have no oil pan, but are mounted on high legs and have large swing, stiff beds, ample belt power, and solid, quick-acting turrets. The beds are deep and strongly ribbed, and are all made with a gap, which greatly increases the capacity of the machine and is a great advantage without introducing any inconvenience whatever. In the larger sizes, the gap has the additional practical advantage that the ways for the turret slide are kept clear of chips, while the turrets have the solidity due to sliding directly on the bed.

The head stocks are the same as those of the corresponding screw machines. In the larger machines, the draw-back collets are bushed down for smaller diameters, so that but a few collets are necessary. The automatic draw-back chucks used in all these machines are provided with an inside stop, so that there is no end movement or variation in position of the work in gripping. A special design of spring collet with large opening and arranged to take false jaws for irregular-shape work, is made. This collet has no end movement, and is controlled by foot motion, and is specially desirable for gas fixtures and similar work requiring rapid handling.

The spindles have large holes, and are threaded to take lathe chucks or face plates. The turrets have a clear passage right through for long work; are automatic except the largest size, and are provided with a stop which checks the momentum and permits rapid working without damage to the lock bolt.

The two larger size turrets are hexagonal, and have individual trip and stop for each tool. The power feeds to the turrets are positively driven and provided with gear changes, and in the larger sizes there is provision for quick change from slow to fast, or vice versa.

The turret slides are the same as those of the corresponding screw machines, and have large wearing surfaces and long travel.

The small sizes are hand feed, and the large sizes power feed. The cross slides set on the gap and allow a large swing over them. The two smaller sizes are lever feed and the other screw feed. Plug and set screw stops are provided, which are entirely protected and do not spring. In the larger sizes, cross adjustment for the tools is provided, which is a convenience in setting the tools and may be utilized for auxiliary turning operations. Forming attachments carrying a vertical draw-cut tool can be mounted in the cross slides and the whole face of the work turned at one cut. The machines, except the two largest, are also built with extra capacity spindles and designated by separate number.

Specification of No. 21 and No. 31 Monitor or Chucking Lathe.

This machine is specially suited for light brass working and small hardware articles, as made from the rod or separate castings, as required in the manufacture of valves, gas, and electric fixtures, plumbers' supplies, etc. Pieces can be chucked, turned up, drilled, threaded, counterbored, etc., with great rapidity.

The head stock and turret is similar to our No. 1 Screw Machine. The spindle has large bearings, and we recommend it fitted with draw-back collet, which is specially well suited for holding castings. The turret is fitted with a special stop, which releases the lock bolt of the blow due to the momentum of the turret, and makes it specially well adapted for rapid work.

The cross slide sets on the gap, has lever feed, and is provided with plug stops. We make a forming attachment, worked by vertical lever, to set on the cross slide, which is very rapid, as the piece is formed complete at one cut.

A special feature can be added to the forming attachment for turning tapers, such as brass cocks, etc.

Regular collets in stock for No. 21 Machine are: $\frac{1}{8}$ in. to $\frac{5}{8}$ in., varying by thirty-seconds.

Regular collets in stock for No. 31 Machine are: $\frac{1}{4}$ in. to $\frac{7}{8}$ in., varying by thirty-seconds.

Other sizes, special price.

For general description, see page 95.

	No. 21.	No. 31.
Capacity with wire feed.....	$\frac{5}{8}$ in.	$\frac{7}{8}$ in.
Capacity without wire feed.....	13-16 in.	1 $\frac{1}{4}$ in.
Swing over gap.....	12 in.	12 in.
Largest diameter of cone.....	6 $\frac{1}{2}$ in.	6 $\frac{1}{2}$ in.
Width of belt.....	2 in.	2 in.
Length of bed.....	36 in.	36 in.
Diameter of turret.....	4 $\frac{5}{8}$ in.	4 $\frac{5}{8}$ in.
Size of holes in turret.....	11-16 in.	11-16 in.
Number of holes in turret.....	6	6
Center of holes to turret slide.....	1 $\frac{1}{2}$ in.	1 $\frac{1}{2}$ in.
Turning length	3 in.	3 in.
Weight, domestic shipment, crated.....	600 lbs.	600 lbs.
Weight, foreign shipment, tight boxed (23 c. f.).....	800 lbs.	800 lbs.
Friction pulleys on countershaft.....	8x3 in.	8x3 in.
Speed of countershaft, revolutions per minute.....	360-625	360-625
Floor space required.....	56x28 in.	56x28 in.

For tools and attachments, see pages 117 to 125.

Specification of No. 22 and No. 32 Monitor or Chucking Lathe.

This machine is adapted to the larger size brass working, and working up of small gears, knobs, hand wheels, pulleys, sleeves, etc., as used in general manufacturing.

The head stock and turret is similar to the No. 2 Screw Machine. The spindle has large hole, and in the Wire Feed style we recommend draw-back collet as better adapted for holding castings. The turret is well adapted for rapid working, and the turret slide has large bearing surfaces and long travel.

The cross slide has lever feed with plug stops. A forming attachment carrying a draw cut tool can be mounted on the cross slide, which adds very materially to the efficiency of the machine. A special feature can be added to the forming attachment for turning tapers.

Regular collets in stock for No. 22 Machine are: $\frac{1}{4}$ in. to $\frac{7}{8}$ in., varying by thirty-seconds.

Regular collets in stock for No. 32 Machine are: $\frac{1}{2}$ in. to $1\frac{1}{4}$ in., varying by sixteenths.

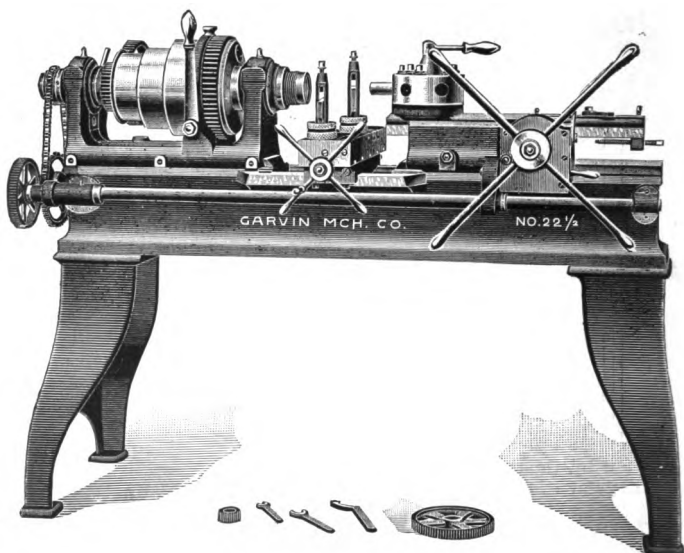
Other sizes, special prices.

For general description, see page 95.

	No. 22	No. 32.
Capacity with Wire Feed.....	$\frac{7}{8}$ in.	$1\frac{1}{4}$ in.
Capacity without Wire Feed.....	$1\frac{1}{4}$ in.	1 9-16 in.
Swing over gap.....	14 in.	14 in.
Largest diameter of cone.....	$8\frac{1}{2}$ in.	$8\frac{1}{2}$ in.
Width of belt.....	$2\frac{1}{2}$ in.	$2\frac{1}{2}$ in.
Length of bed.....	50 in.	50 in.
Diameter of turret.....	$6\frac{1}{8}$ in.	$6\frac{1}{8}$ in.
Number of holes in turret.....	6	6
Size of holes in turret.....	1 in.	1 in.
Center of holes to turret slide.....	$1\frac{3}{4}$ in.	$1\frac{3}{4}$ in.
Turning length	6 in.	6 in.
Friction pulleys on countershaft.....	10x3 in.	10x3 in.
Speed of countershaft, revolutions per minute.....	260-425	225-375
Floor space required.....	62x32 in.	62x32 in.
Weight, domestic shipment, crated.....	975 lbs.	975 lbs.
Weight, foreign shipment, tight boxed....	33 c. f. 1,200 lbs	1,200 lbs.

For tools and attachments, see page 117 to 125.

232211



No. 22 1/2 and No. 32 1/2 Monitor or Chucking Lathe, with Geared Friction Head and Power Feed to Turret.

No. 32 1/2 is the No. 22 1/2 Machine with increased spindle capacity.

	Code No. 22 1/2.	Words. No. 32 1/2.
Machine with Wire Feed, but no gearing or turret feed	(Beatific)	(Beatitude)
Machine with Wire Feed, with Power Feed to Turret, but no gearing.....	(Beautiless)	(Bechance)
Machine with Wire Feed, with Geared Friction Head, but no Turret Feed.....	(Becharm)	(Bechie)
Machine with Wire Feed, with Geared Friction Head, and Power Feed to Turret	(Becket)	(Becking)
Above code words are for machines with Style B collets. If any other style is desired, add proper letter (see page 118) to above code word, viz.: Bechie, Style E.		
Machine without Wire Feed, but no gearing or turret feed.....	(Blier)	(Beclip)
Machine without Wire Feed, with Power Feed to turret, but no gearing.....	(Becloud)	(Becurl)
Machine without Wire Feed, with geared Friction Head, but no turret feed.....	(Bedabble)	(Bedaff)
Machine without Wire Feed, with Geared Friction Head, and Power Feed to Turret, as shown.....	(Bedagat)	(Bedare)

(Continued on next page.)

	Code Words.	
	No. 22½.	No. 32½.
Machine with Automatic Chuck, but no gearing or turret feed.....	(Bedash)	(Bedel)
Machine with Automatic Chuck, with Power Feed to Turret, but no gearing.....	(Bedevil)	(Bedight)
Machine with Automatic Chuck, with Geared Friction Head, but no turret feed	(Bedizen)	(Bedlam)
Machine with Automatic Chuck, with Geared Friction Head, and Power Feed to Turret.....	(Bedmate)	(Bedote)

Above code words are for machines with Style E collets. If any other style is desired, add proper letter (see page 118) to above code word, viz.: Bedash, Style G.

Vertical Forming Attachment (for any these machines), use extra word.....	(Biscuit)	(Biscuit)
Taper Turning Attachment (used only with Forming Attachment), use extra word..	(Bit)	(Bit)
Three-speed Countershaft (for any these machines), use extra word.....	(Bedrop)	(Bedrop)

Specification of No. 22½ and No. 32½ Monitor or Chucking Lathe.

The head stock is made plain or friction back gear, with or without wire feed or automatic chuck, and with or without power feed to turret. The friction back gear and power feed to the turret are both very desirable features and earnestly recommended.

The turret is provided with a binder and operated by large capstan, giving power and easy movement. The power feed is driven by gearing with four changes and a slip friction introduced.

The cross slide sets on the gap, has screw feed, which permits heavy cuts without chatter and plug stops, entirely protected.

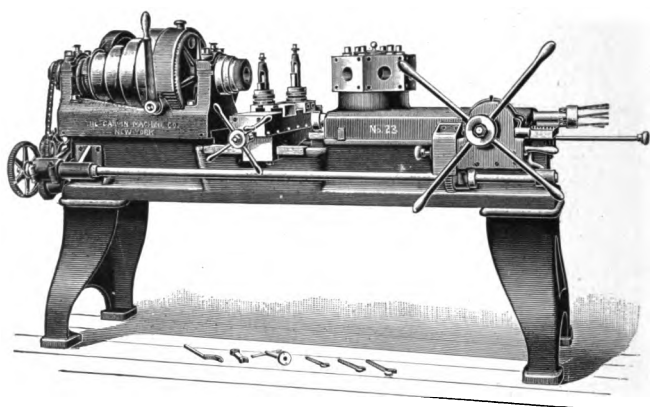
Regular collets in stock for No. 22½ Machine are: ½ in. to 1¼ in., varying by sixteenths.

Regular collets in stock for No. 32½ Machine are: ¾ in. to 1 15-16 in., varying by sixteenths. Other sizes, special price.

For general description, see page 95.

	No. 22½.	No. 32½.
Capacity with Wire Feed.....	11¼ in.	1 15-16 in.
Capacity without Wire Feed.....	1 9-16 in.	2 5-16 in.
Swing over gap.....	18 in.	18 in.
Largest diameter of cone.....	11 in.	11 in.
Width of belt, plain.....	3½ in.	3½ in.
Width of belt, geared.....	2¾ in.	2¾ in.
Length of bed.....	60 in.	60 in.
Diameter of turret.....	7½ in.	7½ in.
Number of holes in turret.....	6	6
Size of holes in turret.....	1¼ in.	1¼ in.
Center of holes to turret slide.....	2½ in.	2½ in.
Turning length	8 in.	8 in.
Friction pulleys on countershaft.....	12x4 in.	12x4 in.
Speed of countershaft, revolutions per minute....	220-325	200-275
Floor space required.....	80x30 in.	80x30 in.
Weight, domestic shipment, crated.....	1,450 lbs.	1,450 lbs.
Weight, foreign shipment, tight boxed.....	1,850 lbs.	1,850 lbs.
	65 c. f.	65 c. f.

For tools and attachments, see pages 117 to 125.



No. 23 Monitor or Chucking Lathe, with Geared Friction Head and Power Feed to Turret.

- Machine with Style E Wire Feed, with Geared Friction Head and Power Feed to Turret.....(**Beeld**)
- Machine without Wire Feed, with plain Back Gears and Power Feed to Turret.....(**Beemol**)
- Machine without Wire Feed, with Geared Friction Head and Power Feed to Turret, as shown.....(**Befoam**)
- Machine with Style E Automatic Chuck, with Geared Friction Head and Power Feed to Turret.....(**Befool**)
- Vertical Forming Attachment (for any above machines), use extra word.....(**Blsect**)
- Taper Turning Attachment (used only with Forming Attachment), use extra word.....(**Bitten**)
- Three-speed Countershaft regularly furnished with any of the above machines.

(See page 94.)

Specification of No. 23 Monitor or Chucking Lathe.

This tool combines every feature that an efficient machine of this class should possess. Heavy head stock, large spindle, large cone with friction back gear 8 to 1, sixteen changes of speed, and reverse, deep bed, with increased swing over gap and cross slide, turret slide fitted direct on bed, swing for large turret tools, hexagonal turret, independent trip and stop for each turret tool, clear hole through turret, turret unlocked, indexed, locked and bound, all automatically, and can be set to operate at any part of the bed.

A positively driven feed, with slip friction for emergencies, eight changes, and quick change from slow to fast, is provided.

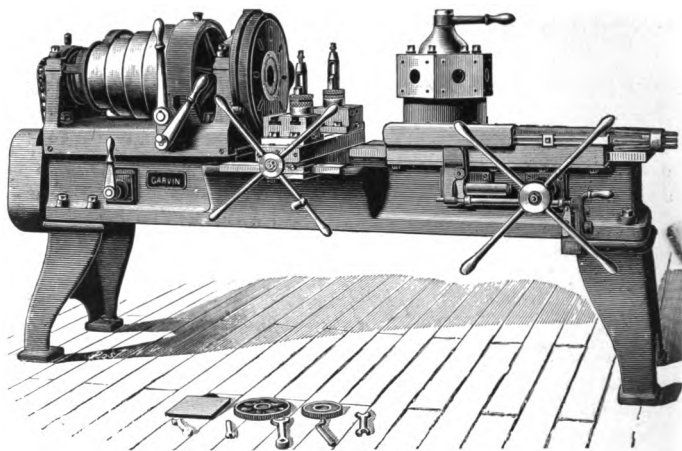
The machine is made with friction head and power feed, with or without wire feed or automatic chuck. Draw-back collets, without overhang, are used. A three-speed countershaft is furnished, giving sixteen changes of speed and reverse.

Regular bushings in stock for this machine, all sizes, varying by sixteenths.

For **general description**, see page 95.

Capacity with Wire Feed.....	1 15-16 in.
Capacity without Wire Feed.....	2 5-16 in.
Swing-over gap	22 in.
Largest diameter of cone.....	13½ in.
Back gear	8 to 1
Width of belt.....	3 in.
Length of bed.....	80 in.
Diameter of turret.....	11 in.
Number of holes in turret.....	6
Size of holes in turret.....	2 in.
Center of holes to turret slide.....	5½ in.
Travel of turret slide.....	20 in.
Friction pulleys on countershaft.....	16x4 in.
Speed of countershaft, revolutions per minute.....	120-180
Floor space required.....	36x100 in.
Domestic shipment, crated, weight.....	3,350 lbs.
Foreign shipment, tight boxed (164 c. f.), weight.....	4,150 lbs.

For tools and attachments, see pages 117 to 125.



**No. 24 Monitor or Chucking Lathe, with Geared Friction Head,
Geared Face Plate, and Power Feed to Turret.**

- Machine with Style E Wire Feed, with Geared Friction Head and Power Feed to Turret..... (**Begilt**)
- Machine without Wire Feed, with Plain Back Gears, and Power Feed to Turret.....(**Beguards**)
- Machine without Wire Feed, with Geared Friction Head, and Power Feed to Turret, as shown.....(**Basalt**)
- Machine with Style E Automatic Chuck, Geared Friction Head, and Power Feed to Turret.....(**Begird**)
- Vertical Forming Attachment (for any above machines), use extra word.....(**Bistre**)
- Taper Turning Attachment (used only with Forming Attachment), use extra word.....(**Bicep**)
- Three-speed Countershaft regularly furnished with any of the above machines.
- (See page 94.)

Specification of No. 24 Monitor or Chucking Lathe.

This machine is designed to meet the requirements of large chucking work, as required in manufacturing electric motors, motor vehicles and their engines, and general machine-shop work. All parts are similar to the No. 14 Screw Machine.

A heavy spindle is provided, carrying a large four-step cone, friction geared 8 to 1, and with geared face plate 14 to 1 for the larger work. The change to face plate drive is quickly made from the front. The turret has large surfaces and great swing for large tools and independent trip and stop for each tool. The turret slide works easily, and is fitted direct on the bed. The feed is positive, with gear changes and a friction slip to avoid accidents. Turning feeds and a separate set of accurate screw-cutting pitch feeds are furnished, with provision for changing from one class of feed to the other instantly. An index is provided.

The face plate gear is arranged for bolting on work or fixtures, or to take a large lathe chuck. A substantial cross slide spans the large gap, and is arranged to pass under the face plate gear. The tool post blocks have a cross adjustment for setting tools, and the blocks are also adjustable lengthways of the main cross slide, to suit the diameter of the work with the least movement of cross slide, and to render the full swing available. The machine is built with power feed, with or without wire feed or automatic draw-back spring collet worked by pilot wheel. A three-speed friction countershaft is furnished.

Regular bushings in stock for this machine, all sizes, varying by sixteenths.

For general description, see page 95.

Capacity with automatic draw-back chuck.....	2½ in.
Capacity without automatic draw-back chuck.....	3¼ in.
Swing over gap.....	30 in.
Largest diameter of cone.....	16 in.
Width of belt.....	3½ in.
Length of bed.....	90 in.
Diameter of turret.....	12½ in.
Number of holes in turret.....	6
Size of holes in turret.....	2½ in.
Center of holes to turret slide.....	8¼ in.
Turning length	16 in.
Feed of turret slide.....	26 in.
Friction pulleys on countershaft.....	16x4 in.
Speed of countershaft, revolutions per minute.....	165-100
Floor space required.....	120x45 in
Weight, domestic shipment, crated.....	4,200 lbs.
Weight, foreign shipment, tight boxed (170 c. f.).....	5,100 lbs.

For tools and attachments, see pages 117 to 125.

Specifications of Forming Machines.

No. 1. No. 2. No. 2½. No. 3.

The great saving in making pieces from the bar, as distinguished from separate castings, has led to a great extension in this line, and for this class of work we build a line of machines similar to that shown in the cut.

These machines are particularly adapted to chandeller and electrical fixture work, in making ornamental knobs and joints from large brass rod and tubing, manufacturing bicycle parts, such as hubs, pedal barrels, pedal pins, crank axles, etc., which may be put in double turret machines for the final operations on the ends, and for turning out articles in hard rubber and fiber, for which the large capacity offers special advantages.

The spindles of these machines are of very large capacity to take in large rods, and are driven by large face cones.

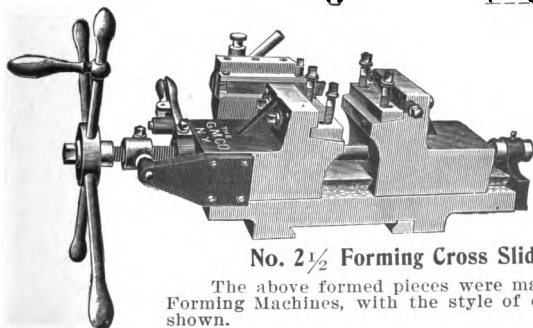
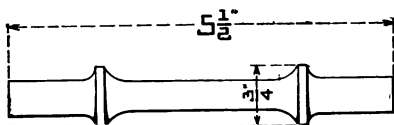
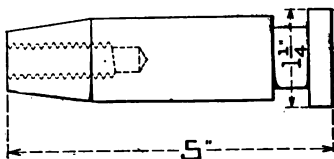
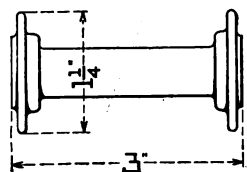
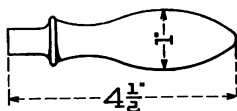
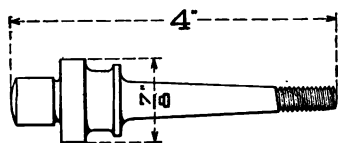
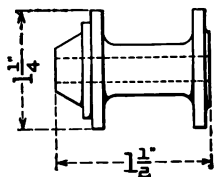
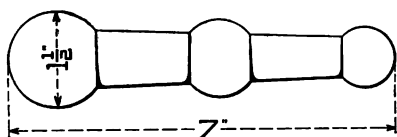
A tail stock replaces the usual turret, and serves as a steady rest for the piece being formed, and also as a gauge for the length. The cross slide carrying the forming tools is a special feature of these machines, assisting them to turn out a very large output.

A roughing tool is mounted on the rear slide and a finishing tool on the front, the cutting being done with both tools until the piece is nearly finished, when the roughing tool, which has a notched cutting edge to break up the chip and avoid chatter, is withdrawn, and the piece sized with the finishing tool.

These tools are flat, about 1 inch thick, and as wide as 7 inches on the larger sizes, and may be ground on the face without altering their shape.

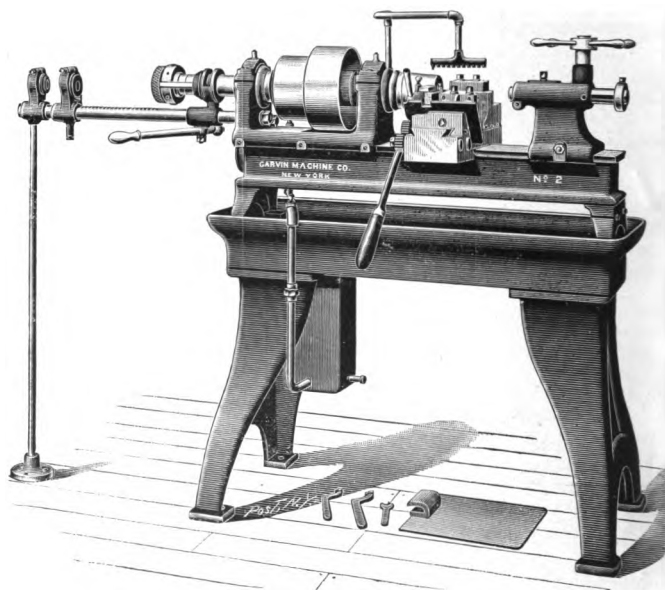
They are closely adjusted by wedges and set by a gauge, which is furnished. A cutting off tool is carried on the front tool slide, and is advanced into position for cutting off, which is done at increased speed. The stop on these machines is on the screw and can not be strained, making it possible to maintain exact size. A turret may be used instead of the tail stock, and short pieces formed, drilled, tapped, counterbored, etc., and cut off entirely finished. A large oil pan is provided, and pump and flexible pipe connections furnished.

A two-speed friction countershaft, giving quick speed for cutting off, is furnished.



No. 2 1/2 Forming Cross Slide.

The above formed pieces were made on our Forming Machines, with the style of cross slide shown.



No. 2 Forming Machine with Wire Feed and Drilling Attachment.

	Code Word.	
	No. 1.	No. 2.
Machine with Wire Feed and Drilling Attachment, as shown	(Blotter)	(Bleeding)
Three-speed Countershaft, use extra word....	(Bowl)	(Bout)
(See page 94.)		

Specification of No. 1 and No. 2 Forming Machines.

These machines are substantially alike in general design, the No. 2 being proportionately heavier.

The machines have the same beds as the corresponding screw machines. A tail stock is used instead of the usual turret, and a compound forming cross slide replaces the ordinary slide.

The No. 1 Machine is adapted for the rapid production of an endless variety of small pins, knobs, handles, etc., as required in the manufacture of electrical goods, typewriters, hardware, etc.

The No. 2 Machine is suitable for brass working, valves, cocks, plumbers' supplies, chandeller work, etc. The articles are formed from the solid bar at one broad cut by form tools, which are carried on a compound cross slide and fed up from the front and rear simultaneously.

The rear tool is the roughing tool, and is notched to break up the chip, and the front tool smooths off the ridges and finishes the work. The slides are fed in by geared lever and link connection, so arranged that when nearly to size the roughing tool moves back and the finishing tool takes the sizing cut. The tools are adjusted by wedges, and can be ground on the face without altering their form.

A cutting-off tool is carried on the front slide and arranged to be thrown into the forward position to cut off the piece.

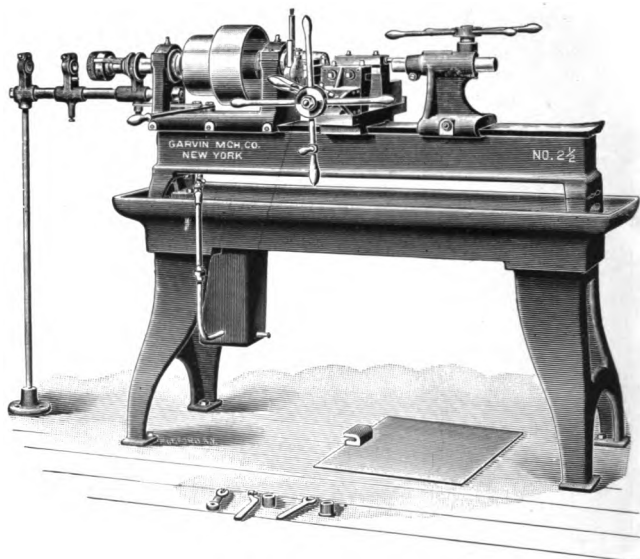
The tail stock spindle is moved by capstan wheel and fitted with bushing to support the end of the piece being formed, and serves also as a gauge for length. The tail stock also carries a drill bushing and jig eye for drilling the work being formed.

The regular turret and slide can be provided instead of the tail stock and the work formed, drilled, counterbored, threaded, and cut off complete.

The forming cross slide is furnished separately for use on regular screw machines.

For general description, see page 106.

	No. 1.	No. 2.
Floor space required.....	42x22 in.	56x26 in.
Capacity of wire feed.....	$\frac{5}{8}$ in.	$\frac{7}{8}$ in.
Capacity without wire feed.....	13-16 in.	1 $\frac{1}{4}$ in.
Width of cross slide.....	3 $\frac{1}{2}$ in.	4 $\frac{7}{8}$ in.
Largest diameter of cone.....	6 in.	8 $\frac{1}{2}$ in.
Length of bed.....	32 in.	38 in.
Width of belt.....	2 in.	3 $\frac{1}{2}$ in.
Swing over bed.....	9 in.	10 $\frac{1}{2}$ in.
Length that can be formed.....	2 $\frac{1}{4}$ in.	4 in.
Friction pulleys on countershaft.....	8x3 in.	10x3 $\frac{1}{2}$ in.
Speed of countershaft, iron, revolutions per minute.....	300	260
Speed of countershaft, brass, rev. per minute.....	625	425
Domestic shipment, crated, weight.....	585 lbs.	975 lbs.
Foreign shipment, tight boxed.....	870 lbs.	1,250 lbs.
	28 c. f.	37 c. f.



No. 2 $\frac{1}{2}$ Forming Machine with Wire Feed and Drilling Attachment.

		Code Word.	
		No. 2½	No. 3
Machine with Wire Feed and Drilling Attachment, as shown “ “ “ “ “ “ and		Bywalk	Byspeech
Power Feed to Cross Slide....		Byway	Bylaw
“ “ “ “ “ Drilling Attachment and			
Geared Friction Head.....		Bywipe	Byard
“ “ “ “ “ Drilling Attachment, Geared			
Friction Head, and Power Feed			
to Cross Slide.....		Byroad	Byplay
Three Speed Countershaft for any above machines, use			
extra word.....		Bourn	Boxer

(See page 94)

Specifications of No. 2½ and No. 3 Forming Machines.

These machines are designed for the rapid production of ball handles, taper studs, brass knobs, ornamental nuts, short axles, etc., as required in tool building, brass working, horseless carriages, etc.

The machines are fitted with large capacity spindles and driven by large two-step cones, or friction back geared, and with or without wire feed or automatic chuck.

A large compound cross slide carries a roughing tool at the back and a finishing tool in front, and these tools are fed up simultaneously. Pieces seven inches long can be finished at one broad cut without chatter. A cutting-off tool is carried on the front slide.

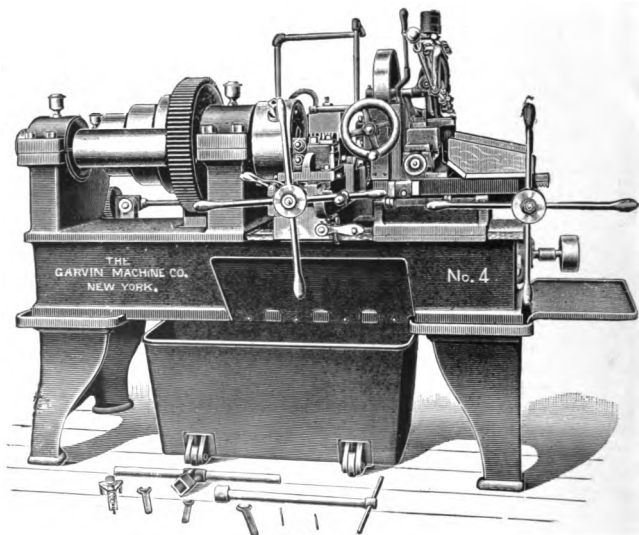
The cross slide is hand feed, but can also be fitted with power feed and automatic trip. The power feed is very desirable when forming long, slender pieces, such as taper axles, etc. The tail spindle supports the end of the piece being formed, and is moved by capstan wheel and fitted with drill bushing and jig eye for drilling the work being formed.

The machine can be supplied with the regular turret, so that pieces can be formed, drilled, counterbored, threaded, and cut off complete.

The forming cross slide is sold separately for use in regular screw machines.

For general description, see page 106.

	No. 2½.	No. 3.
Floor space required.....	72x26 in.	96x33 in.
Capacity of wire feed.....	1¼ in.	1 15-16 in.
Capacity without wire feed.....	1 9-16 in.	2 5-16 in.
Width of cross slide.....	5 in.	5½ in.
Largest diameter of cone.....	11 in.	12 in.
Length of bed.....	54 in.	72 in.
Width of belt, plain.....	3½ in.	4 in.
Width of belt, geared.....	2¾ in.	3½ in.
Swing over bed.....	14 in.	17 in.
Length that can be formed.....	5½ in.	7 in.
Friction pulleys on countershaft.....	12x4 in.	14x4 in.
Speed of countershaft, iron, revs. per minute....	175	165
Speed of countershaft, brass, revs per minute....	250	225
Domestic shipment, crated, weight.....	1,550 lbs.	2,350 lbs.
Foreign shipment, tight boxed.....	1,800 lbs.	3,100 lbs.
	72 c. f.	124 c.f.



No. 4 Forming Machine.

Code Word for Machine, as shown **Quake**
 " " " " with Power Feed Drilling Attachment..... **Quick**

Specification of No. 4 Forming Machine.

The most economical method of manufacturing pieces up to 7 in. or 8 in. long, such as ball handles, studs, sleeves, ball-bearing hubs of bicycles, horseless carriages, etc., is to turn them from the solid bar at one broad cut, and that is what is done in this machine. The machine is massive, and will reduce a 3-in. bar down to $\frac{3}{4}$ -in. neck at one cut without chatter. There is room for a great extension in this direction, and the results are surprising to those not familiar with this line of work.

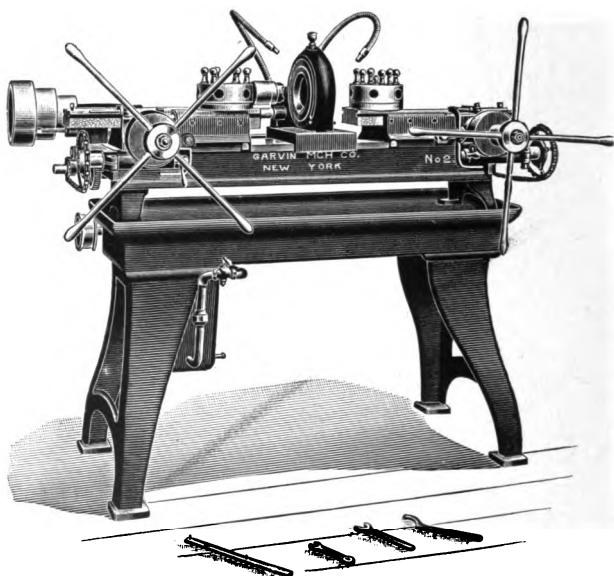
The stock is held in a two-jawed chuck which is solid with the spindle, and the end of the stock under cut is supported by adjustable jaws carried on a carriage, which is moved between stops, and serves to pull in the stock for the next piece. The pieces are severed from the bar by a saw at the same time that the next piece is being formed, so that no time is taken up in cutting off.

The tools are flat, and can be sharpened by grinding on the face without altering their form. These tools show remarkable endurance and are held in adjustable holders and set by a gauge, which is furnished. There are two tools, roughing and finishing, and they cut on the front and rear simultaneously. The roughing tool cuts in ridges that are smoothed off by the finishing tool, and a special form of stop assures absolute uniformity of size.

The machine may be used in the manufacture of horseless carriages. A large oil and chip tank on rollers is provided, with a pump and connection to the tools.

To meet the requirements of those who wish to rough drill while forming the hubs and the sprockets, we make a drilling attachment that is provided with self-oiling drill that washes out the chips and keeps the point of drill cool.

Largest size of bar formed.....	3	in.
Width of cross slide.....	7 9-16	in.
Largest diameter of cone.....	16	in.
Length of bed.....	6	ft.
Width of belt required.....	5	in.
Swing over bed.....	23	in.
Length that can be formed.....	8	in.
Tight and loose pulleys on countershaft.....	16x4	in.
Speed of countershaft, iron, revolutions per minute.....	250	
Speed of countershaft, brass, revolutions per minute.....	350	
Floor space required.....	74x45	in.
Domestic shipment, crated, weight.....	4,525	lbs.
Foreign shipment, tight boxed, size, {	machine, 77x48x63 in.	weight
	countershaft,	5,300 lbs.
	70x24x24 in.	



No. 2 Screw Machine (Double Turret) with Power Feed to Both Ends.

	No 2	No. 2½
Code Word, without Power Feed	Quire	....
“ “ with Power Feed to one end.	Quiz	....
“ “ “ “ “ “ both ends.	Quinine	Bridge

Specification of No. 2 and No. 2½ Screw Machines. (Double Turret.)

These machines are particularly adapted for work which must be operated on at both ends, and be true and in line, such as the ball-bearing hubs and axles of horseless carriages, turn buckles, etc., and pieces having a long hole of small diameter, which it is difficult to drill true in a jig.

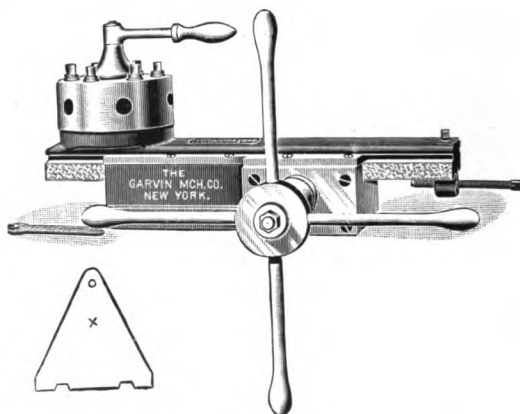
Any shape piece can be handled, and it is not at all necessary that the piece be round.

A great saving of time is effected by working from both ends in this manner, and it insures the ends of the piece running true with each other in the same concentric plane.

The piece is handled but once, so that all loss of time and inaccuracies due to rehandling are avoided. The chuck is driven by gearing, and revolves in anti-friction bearings, thoroughly protected from dirt. The turrets are independent, and are fed up from each side, and the piece drilled, counterbored, faced, and threaded synchronously. The turrets are bored in their places, and the method of working insures the absolute alignment. The power feed to the turrets is provided for either or both ends, as desired, and is always recommended for doing the best work. The feed is positively driven, and a slip-friction is introduced to avoid damage to the machine through carelessness.

Ample provision is made for changes of feed and speed. A three-speed countershaft, giving two forward and one reverse, is furnished. The oil pan is wide and deep, and is provided with double strainers and oil reservoir. An oil pump connected to the chuck by flexible tubing is provided.

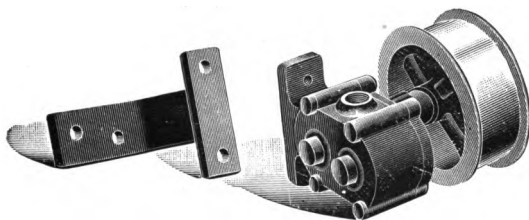
	No. 2	No. 2½
Regular chuck capacity.....	1½ in. dia.	2 in. dia.
Utmost chuck capacity (special).....	2½ in. dia.	4 in. dia.
Thickness of chuck.....	1¼ in.	2½ in.
Length that can be milled.....	4½ in.	6 in.
Maximum distance face of chuck to turret	6½ in.	8 in.
Number of holes in turret.....	6	6
Diameter of turret.....	6½ in.	7½ in.
Diameter of holes in turret.....	1 in.	1¼ in.
Center of turret holes to slide.....	1¾ in.	2 7-16 in.
Friction pulleys on countershaft.....	10x3½ in.	12x4 in.
Speed of countershaft, revs. per minute.	150	175
Floor space required.....	62x27 in.	80x29 in.
Domestic shipment, crated, weight.....	1,050 lbs.	1,910 lbs.
Foreign shipment, tight boxed.....	1,450 lbs. 50 c. f.	2,175 lbs. 69 c. f.



Specification of Automatic Turret.

In response to the demand for a turret that can be fitted to other makes of lathes, we are prepared to make our standard turrets (of which we have five sizes) so that they can be fitted to any lathe. In ordering, parties should send templates (as shown above) fitted to V's of bed and with position of center marked; the template should be plainly marked (X), showing which is the front and head of lathe. With each turret will be sent a set of tools for boring and reaming turret holes in place, to insure perfect line (*these tools are to be returned*). These turrets are the same as those used on our regular screw machines of corresponding numbers, and are made and finished with equal care. The Nos. 00 and 1 are operated by lever, and the Nos. 2, 2½, and 3 by pilot wheel.

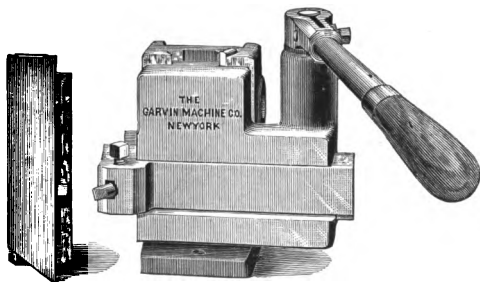
Number of turret.....	00	1	2	2½	3
Code word.....	Befall	Before	Beget	Began	Beggar
Swing of lathe to which turret is adapted.....	6 in.	12 in.	14 in.	16 in.	18 in.
Diameter of turret.....	2¾ "	4⅝ "	6⅛ "	7⅛ "	9⅛ "
Number of holes in turret.....	6	6	6	6	8
Diameter of holes in turret.....	2⅞ in.	1⅛ in.	1 in.	1¼ in.	1½ in.
Length that can be milled.....	2 "	3 "	6 "	8¼ "	9¼ "



Specification of Oil Pump.

To produce the best results on screw machine work, and in a large proportion of milling operations, a copious supply of lubricant is necessary, and for this purpose we make a simple rotary pump which is readily applied in all positions; it will furnish an ample supply, and has a minimum of packed joints.

Width of belt required.....	1 1/4 in.
Speed of pump.....	150 rev.
Size of pipe used.....	3/8 in.
Pump, without countershaft.....	(Bemoan)
Pump, with countershaft.....	(Bemoack)



Specification of Taper Turning Attachment and Vertical Forming Attachment.

For turning taper plugs, cocks, valves, etc., we furnish the attachment shown.

The attachment is mounted on the cross slide of a screw machine, or monitor lathe, and can be swiveled to suit the angle of taper required. The tool is clamped in a horizontal slide, and has a rack and pinion movement, by long lever, giving a quick and steady motion.

The movement of the cross slide is available for bringing the tool up, and throwing back out of the way. The horizontal slide may be removed, and a vertical slide carrying draw-cut tools substituted, and the same fixture used for forming pieces from the bar at one cut.

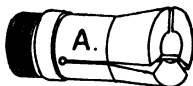
Code word, complete, as shown.....(Bisecting)

Follow code word with number of machine wanted for.

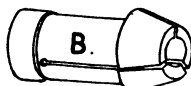
Collet List.



Bushing.



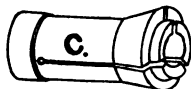
1884 Design



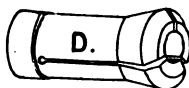
Present Design



Bushing.



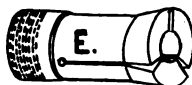
1888 Design.



1889 Design.



Present Design Bushed.



Present Design



Present Design Bushed.

Collet No.	Style.	For S M. Heads.	Collet No.	Style	For S M. Heads.
101	A	00	119	D	2½ and 12
102	A	1	120	D	3
103	A	2	121	E	00
104	A	2½	122	E	1 and 21
105	A	3	123	E	2, 11, 22, and 31
106	B	00	124	E	2½, 12, 22½, and 32
107	B	1, 21	125	E	3, 12½, 13, 23, and 32½
108	B	2, 11, 22, and 31	126	E	14 and 24
109	B	2½, 12, 22½-32	127	F	2½, 12, 22½, and 32
110	B	3, 12½, and 32½	128	F	3, 12½, and 32½
111	C	00	129	G	2½, 12, 22½, and 32
112	C	1	130	G	3, 12½, 13, 23, and 32½
113	C	2	131	G	14 and 24
114	C	2½	132	H	For Collet 127
115	C	3	133	H	" " 128
116	D	00	134	J	" " 129
117	D	1	135	J	" " 130
118	D	2 and 11	136	J	" " 131

We recommend and carry in stock—

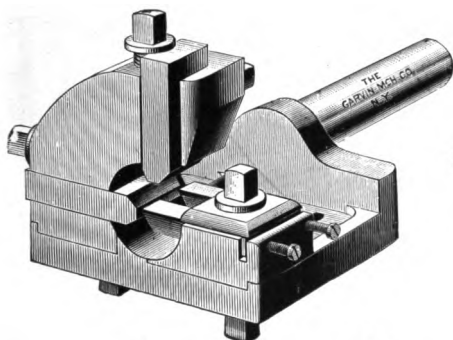
Style B... for No. 00, Nos. 1 and 11, Nos. 2 and 12, and 2½.

" F.... " No. 3, No. 12½.

" E.... " Nos. 22 and 32, Nos. 22½, 21, 31.

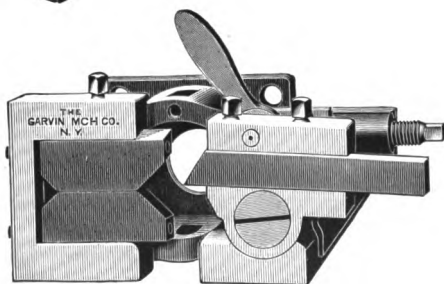
" G.... " Nos. 13, 14, 23, 24, 32½.

In ordering Collets order by " number " only, giving size hole required, viz.:
No. 107, ⅝ hole,



No. 181 to No. 185 are
made in this style.

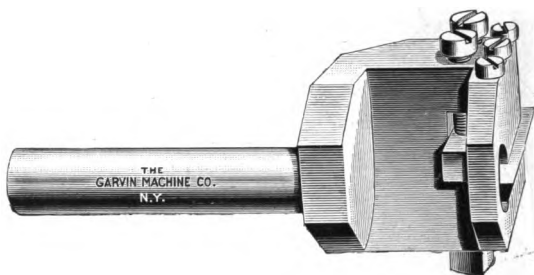
No. 186 and No. 187 are
made in this style.



Adjustable Box Tools.

Code Word—Beguile.

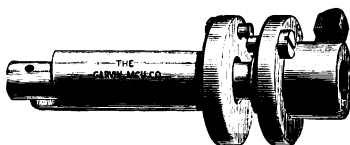
List No	Diameter of Shank	Length of Body.	WILL FINISH.		For Screw Machine Turrets.
			Diameter.	Length.	
181	$\frac{7}{8}$ in.	$2\frac{1}{4}$ in.	$\frac{1}{8}$ in. — $\frac{1}{2}$ in.	$1\frac{3}{4}$ in.	00
182	$\frac{1}{2}$ in.	$3\frac{1}{8}$ in.	$\frac{3}{16}$ in. — $\frac{7}{8}$ in.	$2\frac{1}{4}$ in.	1, 11, 21, 31
183	1 in.	$4\frac{1}{8}$ in.	$\frac{1}{4}$ in. — $1\frac{1}{4}$ in.	$3\frac{3}{8}$ in.	2, 12, 22, 32
184	$1\frac{1}{4}$ in.	$5\frac{1}{8}$ in.	$\frac{3}{8}$ in. — $1\frac{1}{2}$ in.	$4\frac{1}{4}$ in.	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
185	$1\frac{1}{2}$ in.	$5\frac{3}{8}$ in.	$\frac{1}{2}$ in. — $2\frac{1}{8}$ in.	$5\frac{1}{4}$ in.	3, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
186	Base is $6\frac{1}{4}$ in. wide $5\frac{1}{4}$ in. high	—	$\frac{3}{4}$ in. — $3\frac{1}{4}$ in.	under 2 in. Dia. no limit. above 2 in. Dia. $5\frac{1}{4}$ in. long. under $2\frac{1}{2}$ in. Dia. no limit. above $2\frac{1}{2}$ in. Dia. $5\frac{3}{4}$ in. lg	13, 23
187	Base is $7\frac{1}{4}$ in. wide $6\frac{3}{8}$ in. high	—	1 in. — $3\frac{1}{2}$ in.		14, 24



Roughing Box Tools.

Code Word—Begun.

List No.	Diameter of Shank.	WILL MILL.		For Screw Machine Turrets.
		Diameter.	Length.	
171	$\frac{7}{16}$ in.	$\frac{1}{4}$ in.	$\frac{3}{4}$ in.	00
172	$\frac{11}{16}$ in.	$\frac{5}{8}$ in.	$1\frac{1}{8}$ in.	1, 11, 21, 31
173	1 in.	1 in.	$1\frac{5}{8}$ in.	2, 12, 22, 32
174	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$2\frac{3}{8}$ in.	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
175	$1\frac{1}{4}$ in.	$2\frac{3}{8}$ in.	$2\frac{3}{4}$ in.	3, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$



Tap Holders.

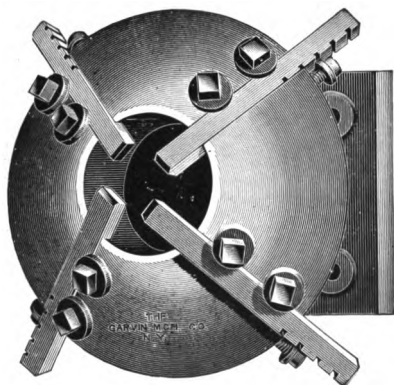
Code Word—Behind.

List No.	Diameter of Shank.	Diameter of Hole for Tap.		For Screw Machine Turret.
201	$\frac{7}{16}$ in.	$\frac{1}{4}$ in.		00
202	$\frac{11}{16}$ in.	$\frac{7}{8}$ in.		1, 11, 21, 31
203	1 in.	$\frac{5}{8}$ in.		2, 12, 22, 32
204	$1\frac{1}{4}$ in.	$\frac{3}{4}$ in.		$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
205	$1\frac{1}{4}$ in.	$\frac{3}{4}$ in.		3
206	2 in.	$1\frac{1}{2}$ in.		13, 23
207	$2\frac{1}{2}$ in.	$1\frac{1}{2}$ in.		14, 24

Adjustable Hollow Mills No. 271 to No. 280
are made in this style.



Tool Holder.



Adjustable Hollow Mill No. 281 and No. 282
is made in this style.

Tool Holders.

Code Word—Belong.

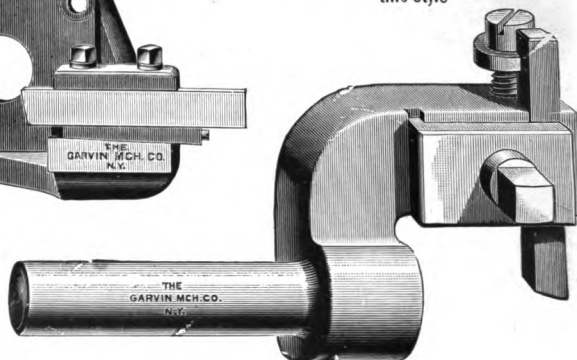
List No.	Diameter of Shank.	Diam. of Hole for Tool	For Screw Machine Turret.
221	$\frac{7}{16}$ in.	$\frac{7}{16}$ in.	00
222	$\frac{1}{8}$ in.	$\frac{1}{8}$ in.	1, 11, 21, 31
223	1 in.	1 in.	2, 12, 22, 32
224	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
225	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	3
226	2 in.	2 in.	13, 23
227	$2\frac{1}{2}$ in.	$2\frac{1}{2}$ in.	14, 24

Adjustable Hollow Mills. Code Word—Beloved.

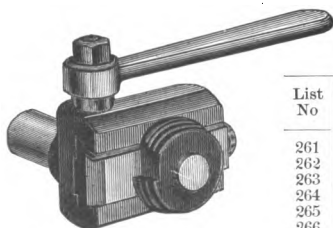
List No.	Diameter of Shank.	Diam. of Body.	Length Over All.	Length of Projec. Body	Capacity.	For Screw Machine Turret.
271	$\frac{7}{16}$ in.	$\frac{7}{16}$ in.	2 in.	—	$\frac{1}{4}$ in.	00
272	$\frac{7}{16}$ in.	$\frac{7}{16}$ in.	—	$1\frac{1}{8}$ in.	$\frac{7}{16}$ in.	00
273	$\frac{11}{16}$ in.	$\frac{11}{16}$ in.	$2\frac{1}{2}$ in.	—	$\frac{7}{16}$ in.	1, 11, 21, 31
274	$\frac{11}{16}$ in.	$\frac{11}{16}$ in.	—	$1\frac{3}{8}$ in.	$\frac{1}{2}$ in.	1, 11, 21, 31
275	1 in.	1 in.	3 in.	—	$\frac{5}{8}$ in.	2, 12, 22, 32
276	1 in.	$1\frac{1}{4}$ in.	—	$1\frac{3}{4}$ in.	$\frac{3}{8}$ in.	2, 12, 22, 32
277	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$3\frac{1}{2}$ in.	—	$\frac{3}{8}$ in.	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
278	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.	—	$1\frac{7}{8}$ in.	1 in.	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
279	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.	$3\frac{1}{2}$ in.	—	$\frac{3}{8}$ in.	3
280	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.	—	$1\frac{7}{8}$ in.	1 in.	3
281	Base is $6\frac{1}{4}$ in wide, $5\frac{1}{4}$ in high.	—	$6\frac{7}{8}$ in.	—	$\frac{3}{4}$ to $3\frac{1}{4}$ in dia. under 2 in dia. Any length above 2 in dia. $5\frac{3}{4}$ in. long.	13, 23
282	Base is $7\frac{1}{4}$ in wide, $6\frac{1}{8}$ in high.	—	$6\frac{7}{8}$ in.	—	1 to $3\frac{1}{4}$ in dia. under $2\frac{1}{2}$ in. dia. Any length above $2\frac{1}{2}$ in. dia $5\frac{3}{4}$ in. lg.	14, 24

Knee Tool for Cast Work.

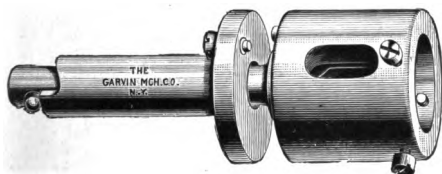
No. 246 and No. 247 are made in this style

No. 241 to No. 245 are made in
this styleKnee Tool for
Cast Work.**Knee Tools.**Code Word—**Belelf.**

List No.	Diameter of Shank.	CAPACITY.		For Screw Machine Turret.
		Diameter.	Length.	
241	$\frac{7}{16}$ in.			00
242	$\frac{1}{8}$ in.	$1\frac{5}{8}$ in.	$1\frac{1}{2}$ in.	1, 11, 21, 31
243	1 in.	$2\frac{1}{4}$ in.	$2\frac{1}{8}$ in.	2, 12, 22, 32
244	$1\frac{1}{4}$ in.	$2\frac{1}{2}$ in.	$3\frac{1}{8}$ in.	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
245	$1\frac{1}{4}$ in.	$2\frac{1}{2}$ in.	$3\frac{1}{8}$ in.	3
246	Base is $6\frac{1}{4}$ in. wide $5\frac{1}{4}$ in. high	$\frac{3}{4}$ in., $4\frac{3}{4}$ in.	under $2\frac{1}{2}$ in. dia. no limit. above $2\frac{1}{2}$ in dia $5\frac{3}{4}$ in long. under $2\frac{1}{2}$ in dia. no limit. above $2\frac{1}{2}$ in dia. $5\frac{3}{4}$ in. lg.	13, 23
247	Base is $7\frac{1}{4}$ in. wide $6\frac{1}{8}$ in. high	$2\frac{1}{2}$ in., 7 in.		14, 24

**Turret Forming Tool.**Code Word—**Belch.**

List No	Diameter of Shank.	For Screw Machine Turret.
261	$\frac{7}{16}$ in.	00
262	$\frac{1}{8}$ in.	1, 11, 21, 31
263	1 in.	2, 12, 22, 32
264	$1\frac{1}{4}$ in.	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
265	$1\frac{1}{4}$ in.	3
266	2 in.	13, 23
267	$2\frac{1}{2}$ in.	14, 24

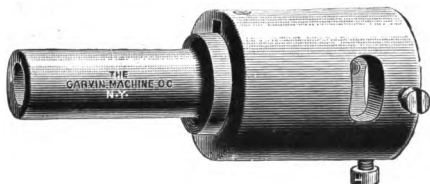


**Solid Shank
Die Holder.**

Code Word—**Behave.**

**Hollow Shank
Die Holder.**

Code Word—**Behest.**



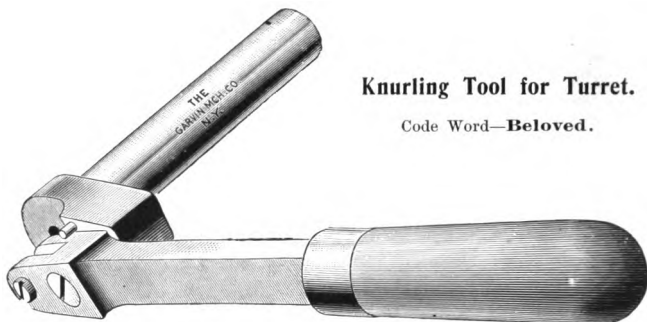
Die Holders.

List No.	Diameter of Shank.	FOR ST. DIES.		Former Symbol.	For Screw Machine Turrets
		Diameter.	Thickness.		
151	$\frac{7}{8}$ in.	$\frac{49}{64}$ in.	$\frac{15}{64}$ in.	00 A	00
152	$\frac{7}{8}$ in.	$\frac{1}{2}$ in.	$\frac{1}{3}$ in.	00 B	00
153	$\frac{7}{8}$ in.	$\frac{49}{64}$ in.	$\frac{15}{64}$ in.	1 B	1, 11, 21, 31
154	$\frac{1}{8}$ in.	$\frac{1}{16}$ in.	$\frac{1}{16}$ in.	1 A	1, 11, 21, 31
155	1 in.	$\frac{1}{4}$ in.	$\frac{3}{8}$ in.	2 A	2, 12, 22, 32
156	1 in.	$\frac{1}{4}$ in.	$\frac{1}{2}$ in.	2 B	2, 12, 22, 32
157	$1\frac{1}{4}$ in.	$1\frac{3}{4}$ in.	$\frac{5}{8}$ in.	$2\frac{1}{2}$ B	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
158	$1\frac{1}{4}$ in.	$2\frac{1}{2}$ in.	$\frac{3}{4}$ in.	$2\frac{1}{2}$ A & 3 B	$2\frac{1}{2}$, 3, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
159	$1\frac{1}{4}$ in.	$2\frac{1}{4}$ in.	1 in.	3 A	3
160	—	—	—	—	13, 23
161	—	—	—	—	14, 24

Standard Dies.

Code Word—**Beveling.**

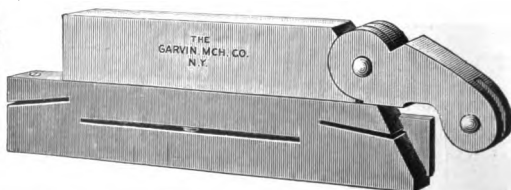
List No.	Diameter.	Thickness.	To be Used on Screw Mches.
321	$\frac{49}{64}$ in.	$\frac{15}{64}$ in.	00
322	$\frac{1}{2}$ in.	$\frac{1}{3}$ in.	00
323	$1\frac{1}{8}$ in.	$\frac{1}{2}$ in.	1, 11, 21, 31
324	$\frac{49}{64}$ in.	$\frac{15}{64}$ in.	1, 11, 21, 31
325	$1\frac{3}{4}$ in.	$\frac{5}{8}$ in.	2, 12, 22, 32
326	$1\frac{1}{2}$ in.	$\frac{1}{2}$ in.	2, 12, 22, 32
327	$2\frac{1}{4}$ in.	$\frac{3}{4}$ in.	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
328	$1\frac{3}{4}$ in.	$\frac{5}{8}$ in.	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
329	$2\frac{1}{8}$ in.	1 in.	3
330	$2\frac{1}{4}$ in.	$\frac{3}{4}$ in.	3



Knurling Tool for Turret.

Code Word—**Beloved**.

List No.	Diameter of Shank.		For Screw Machine Turret.
291	$\frac{7}{8}$ in.		00
292	$\frac{1}{8}$ in.		1, 11, 21, 31
293	1 in.		2, 12, 22, 32
294	$1\frac{1}{4}$ in.		$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
295	$1\frac{1}{2}$ in.		3

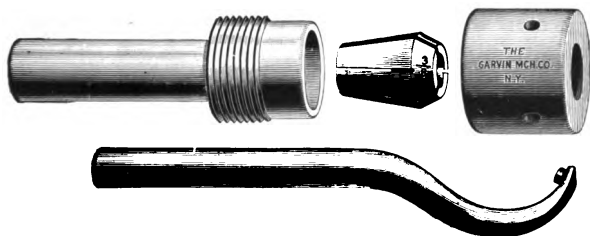
Knurling Tool
for
Cross Slide.Code Word—
Beau.

List No.	Length of Body.		For Screw Machine Cross Slide.
301	$2\frac{1}{2}$ in.		00
302	4 in.		1, 11, 21, 31
303	4 in.		2, 12, 22, 32
304	$5\frac{1}{2}$ in.		$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
305	$5\frac{1}{8}$ in.		3

Cutting-off Tool.

Code Word—**Bellow**.

List No.	Dimensions of Holder.	Thickness of Blade.	Width of Blade.	For Screw Machine.
351	$\frac{5}{16}$ x $\frac{3}{4}$ x $4\frac{1}{2}$ in.	$\frac{5}{16}$ in.	$\frac{1}{2}$ in.	1, 11, 21, 31
352	$\frac{5}{16}$ x 1 x 5 in.	$\frac{1}{8}$ in.	$\frac{1}{4}$ in.	2, 12, 22, 32
353	$\frac{1}{2}$ x $1\frac{3}{8}$ x 6 in.	$\frac{3}{8}$ in.	$\frac{1}{2}$ in.	$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
354	$\frac{15}{32}$ x $1\frac{1}{4}$ x 6 in.	$\frac{3}{8}$ in.	$\frac{1}{2}$ in.	3



Collet Chucks for Turret.

Code Word—**Belly.**

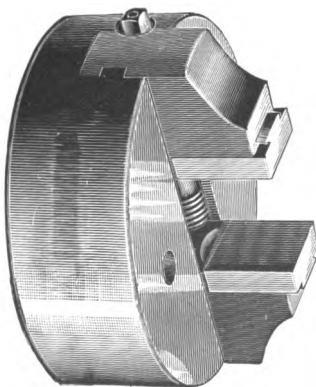
List No.	Diameter of Shank.		For Screw Machine Turret.
311	$\frac{7}{16}$ in.		00
312	$\frac{1}{8}$ in.		1, 11, 21, 31
313	1 in.		2, 12, 22, 32
314	$1\frac{1}{4}$ in.		$2\frac{1}{2}$, $12\frac{1}{2}$, $22\frac{1}{2}$, $32\frac{1}{2}$
315	$1\frac{1}{4}$ in.		3
316	2 in.		13, 23
317	$2\frac{1}{2}$ in.		14, 24



Two-Jaw Screw Machine Chuck.

Code Word—**Belate.**

Follow Code Word with Number of Machine wanted for.



Round Body Two-Jaw Chuck, with Slip Jaws.

Code Word—**Belfry.**

Follow Code Word with Number of Machine wanted for.

Special Set of Tools for Use on No. 1 Screw Machine.

- 4 Collets. 1 each, $\frac{1}{4}$ inch, 5-16 inch, $\frac{3}{8}$ inch, and $\frac{1}{2}$ inch.
 - 1 Die Holder.
 - 1 Tap Holder.
 - 1 Adjustable Box Tool.
 - 1 Tool Holder.
 - 1 Cutting-off Tool and Holder.
- (See pages 118 to 125.)

Special Set of Tools for Use on No. 2 Screw Machine.

- 6 Collets. 1 each, 7-16 inch, $\frac{1}{2}$ inch, 9-16 inch, $\frac{5}{8}$ inch, 11-16 inch, and $\frac{3}{4}$ inch.
 - 1 Die Holder.
 - 1 Tap Holder.
 - 1 Adjustable Box Tool.
 - 1 Tool Holder.
 - 1 Cutting-off Tool and Holder.
- (See pages 118 to 125.)

The above tools we have found by experience to be the ones most needed in using these sizes of Screw Machines, and have arranged to furnish the complete sets at a very low figure. The special price at which we sell them enables us to furnish the full sets only. If single tools or collets are wanted, see pages 118 to 125.

No. 1 Screw Machine is shown on pages 82 and 83.

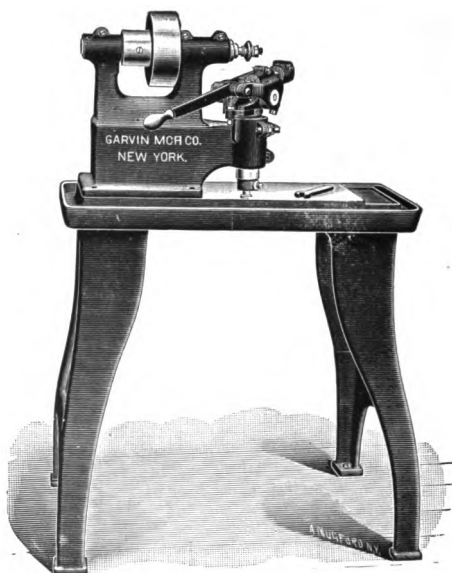
No. 2 Screw Machine is shown on pages 84 and 85.



Specification of Rotary Screw Slotting Machine.

This is a most compact machine, rapid and continuous in its action, and will turn out an immense amount of work. The screws or other small pieces to be slotted or milled are held in notches by separate plungers carried on two disks, which are under spring tension, and the work is passed under the saw and automatically dropped out at the back. Nothing is required but to place the pieces in the jaws as they revolve, so that the utmost rapidity of operation is secured. The saw mandrel is adjustable for setting on the center and for the depth of cut. The machine may be used for milling flats or squares on small work as well as for simple slotting.

Largest diameter of screw handled.....	$\frac{1}{4}$ in.
Width of spindle belt.....	$1\frac{1}{2}$ in.
Tight and loose pulleys on countershaft.....	6x2 in.
Speed of countershaft for brass (driving pulley 14 in.), revolutions per minute.....	200
Speed of countershaft for steel (driving pulley 6 in.), revolutions per minute.....	100
Floor space required.....	22x22 in.
Domestic shipment, crated, weight.....	250 lbs.
Foreign shipment, tight boxed (18 c. f.), weight.....	400 lbs.
Code word, as shown.....	(Quoit)



Specification of Horizontal Screw Slotting Machine.

In the design and construction of this machine our aim has been to produce a simple and convenient tool which could be easily and rapidly operated, and sold at a reasonable price.

The entire operation for gripping and slotting the screw is in a straight downward motion. The upward return motion releases the work and leaves the jaws ready for another piece.

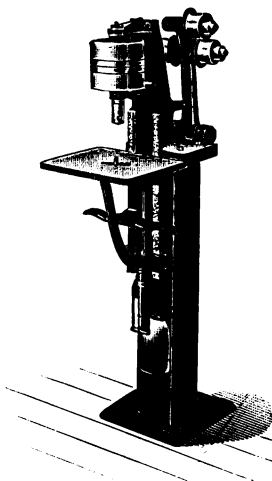
One jaw being adjustable, screws from 3-16 to $\frac{1}{2}$ inch diameter can be handled without trouble of changing any of the parts. The bearings of the machine are all adjustable, to compensate for wear, and convenient adjustments provide for position and depth of slot.

A cone pulley is provided on the spindle to better adapt it to a wider range between large and small screws and for steel and brass.

Aside from screw slotting, the machine may be applied to various forms of light milling where extra speed of handling is desired.

The clamping device for holding the screw can be swung to one side when down, for removing and inserting work without danger of hitting the saw. It is also balanced by a spring which can be adjusted to any tension.

Largest diameter of screw handled.....	$\frac{5}{8}$ in.
Floor space required.....	26x30 in.
Width of spindle belt.....	2 in.
Tight and loose pulleys on countershaft.....	8x2 $\frac{1}{2}$ in.
Speed of countershaft, revolutions per minute.....	155
Domestic shipment, crated, weight.....	265 lbs.
Foreign shipment, tight boxed (11 c. f.), weight.....	415 lbs.
Code word, as shown.....	(Cabin)



Specification of Vertical Tapping Machine.

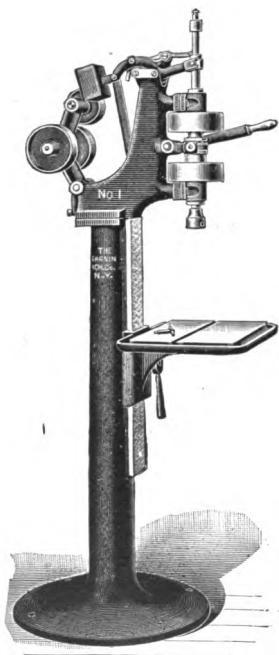
The spindle is driven directly by a continuous belt and a friction disk between two pulleys, which connects the spindle with either at will. This disk has but a small vertical motion, insuring the quick reversing of the tap, small wear, and no noise.

The table is counterbalanced by a weight and provided with a knee lift, allowing the full use of both hands for holding the work. An adjustable screw-stop limits the motion of the table in either direction, and insures a uniform depth of tapping. The machine can be arranged to do left-hand tapping by changing the position of one of the idler pulleys at the back.

We arrange them for mounting on a bench when so desired. (The table on the No. 0 size is operated by treadle instead of the knee lift.)

Number of Machine.....	0	1
Floor space required.....	18x12 in.	21x14 in.
Largest tap machine will drive.....	$\frac{1}{8}$ in.	$\frac{1}{4}$ in.
Depth that can be tapped.....	1 in.	2 in.
Greatest distance between chuck and table.....	5 in.	6 in.
Dimensions of table.....	$8\frac{1}{4} \times 5\frac{3}{4}$ in.	10x12 in.
Width of spindle belt.....	1 in.	$1\frac{1}{2}$ in.
Tight and loose pulleys on countershaft.....	$4\frac{1}{2} \times 2$ in.	6×2 in.
Speed of countershaft, revs. per minute.....	220	200
Net weight complete.....	145 lbs.	230 lbs.
Foreign shipment, tight boxed, size.....	8 c.f.	10 c. f.
Foreign shipment, tight boxed, weight.....	200 lbs.	300 lbs.
Code word, mounted with chuck.....	(Canard)	(Candy)
Code word, arranged for bench with chuck...	(Cancer)	(Caned)

Specification of No. 1 Automatic Tapping Machine.



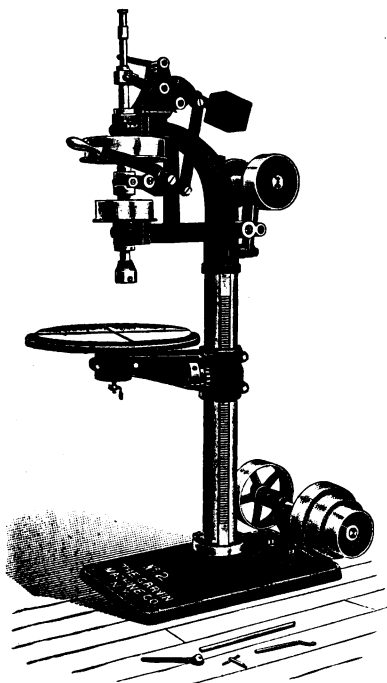
In designing this machine, we have sought to combine lightness, strength, ease, and rapidity of manipulation, together with accuracy and uniformity of the work produced.

The spindle is fitted with two friction pulleys, driven in opposite directions by one continuous belt, and between these pulleys plays a friction clutch keyed to the spindle. This friction clutch is connected with the lever at the right, by a toggle arrangement which is adjustable for any tension desired, so that any extra safety device to prevent breaking of taps is unnecessary. The tap is started by the lever at the right, and is tripped and reversed automatically at any point by an adjustable screw stop on the upper end of the spindle striking the reversing lever on the top of the machine, or by moving this lever by hand. The spindle is balanced and fitted with a chuck for holding taps. The table is rectangular, and has an oil groove around it, and is adjustable up and down on the column to suit the work.

A valuable feature of this tool is that it operates satisfactorily at high speeds, and will trip or reverse after being set, though the operator should continue to press down the starting lever.

Floor space required.....	30x21 in.
Diameter of spindle.....	1 in.
Largest hole that can be tapped.....	5-16 in.
Movement of spindle.....	2 1/4 in.
Dimensions of table.....	11x18 in.
Vertical adjustment of table.....	20 in.
Width of spindle belt.....	1 1/2 in.
Tight and loose pulleys on countershaft.....	6x2 1/2 in.
Speed of countershaft, revolutions per minute.....	200
Domestic shipment, crated, weight.....	435 lbs.
Foreign shipment, tight boxed (33 c. f.), weight.....	550 lbs.
Code word, as shown with chuck.....	(Candle)

Specification of No. 2 Automatic Tapping Machine.

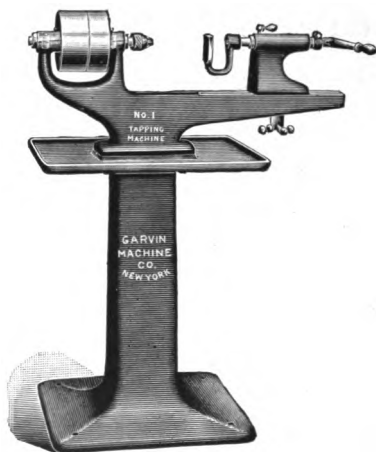


In constructing this machine, gearing has been discarded and the spindle driven through friction clutches controlled by toggle connection, affording ample power and easy release in the most simple manner. The toggle connection can be adjusted to suit the stress on the tap, avoiding the breaking of taps and rendering the use of any safety device unnecessary.

The driving and reversing is provided by an endless belt which secures capacity for high speed without noise or jar. The spindle is pulled down and the clutch automatically thrown in by the downward pull of the lever and a trip, with screw adjustment provided on the upper end of the spindle, regulates depth of tapping. The spindle is counterbalanced, making it very sensitive in starting taps. The table is adjustable in all directions. These machines

are specially adapted for manufacturing, as a large number of holes in a piece can be tapped with great rapidity and uniformity.

Floor space required.....	45x31 in.
Diameter of spindle.....	1 5-16 in.
Largest size of hole that can be tapped.....	$\frac{3}{4}$ in.
Movement of spindle.....	4 in.
Diameter of table inside oil channel.....	21 in.
Vertical adjustment of table.....	20 in.
Width of spindle belt.....	21 $\frac{1}{4}$ in.
Tight and loose pulleys on countershaft.....	10x3 $\frac{1}{2}$ in.
Speed of countershaft, revolutions per minute.....	135
Domestic shipment, crated, weight.....	835 lbs.
Foreign shipment, tight boxed (42 c. f.), weight.....	1,150 lbs.
Code word, as shown, with chuck.....	(Candor)



Specification of No. 1 Horizontal Tapping Machine.

This machine is designed for tapping small holes ranging from 1-16 to 3-16 of an inch in diameter, and is similar in general design to the No. 2 Machine.

The head stock is solid, with the bed and the driving pulleys run on hollow studs, which relieve the spindle of all wear and pressure due to the belt and makes the spindle sensitive to the tap.

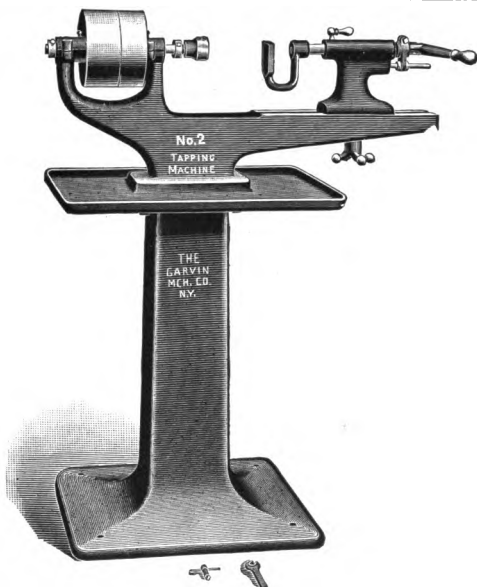
The spindle is fitted with an Almond chuck to hold taps and is driven by a friction clutch working between the two pulleys, which are driven by open and cross belts, insuring instantaneous reversing of the tap.

The tail spindle has a movement of $1\frac{1}{2}$ inches by lever, and is provided with a binder and an adjustable stop collar.

The fore plate is removable, and a taper hole is fitted in the tail spindle to receive tools for drilling purposes.

An oil reservoir is fitted in the bed and a large pan is provided to hold the work.

Floor space required.....	30x19 in.
Greatest distance between chuck and work plate.....	7 $\frac{3}{4}$ in.
Swing over bed.....	6 $\frac{1}{2}$ in.
Width of spindle belt.....	1 $\frac{1}{2}$ in.
Tight and loose pulleys on countershaft.....	6x2 $\frac{1}{2}$ in.
Speed of countershaft, revolutions per minute.....	225
Domestic shipment, crated, weight.....	300 lbs.
Foreign shipment, tight boxed (13 c. f.), weight.....	450 lbs.
Code word, as shown with chuck.....	(Canary)



Specification of No. 2 Horizontal Tapping Machine.

This machine is an efficient tool of thoroughly approved design, and is suitable for tapping holes from 3-16 to $\frac{1}{2}$ inch diameter.

The head stock is solid with the bed and fitted with cap bearings in which run the hubs of the driving pulleys, so that the spindle is freed from the wear and pressure of the belt.

The spindle is driven by a positive clutch working between the two pulleys, and is fitted with an adjustable collar to provide for tapping very shallow holes and a universal three-jawed chuck for holding taps.

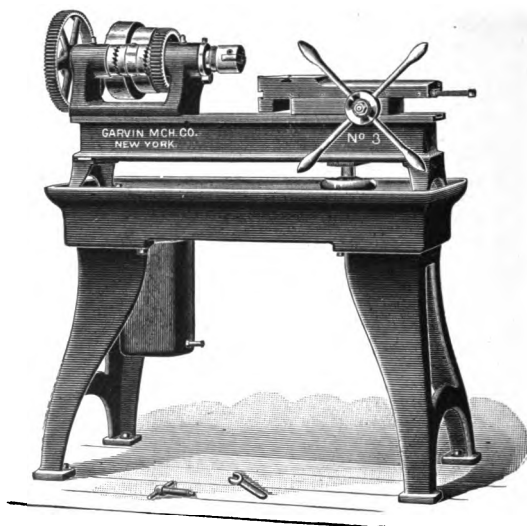
The tail spindle has a movement of 2 inches by lever, and is provided with a binder and an adjustable stop collar.

The fore plate is removable, and the spindle is fitted with a taper hole to receive tools so that the machine may be used for drilling purposes.

An oil reservoir is formed in the bed and a large pan is provided to hold the work.

We can also furnish with this machine a special tail block, arranged with hollow spindle and spring chuck, designed for threading rods or special work that can be best held by the chuck. This fixture has a capacity for 3-16 to $\frac{1}{2}$ inch stock.

Floor space required.....	24x48 in.
Greatest distance between chuck and work plate.....	12 $\frac{3}{8}$ in.
Swing over bed.....	11 in.
Width of spindle belt.....	2 $\frac{3}{4}$ in.
Tight and loose pulleys on countershaft.....	10x3 in.
Speed of countershaft, revolutions per minute.....	150
Domestic shipment, crated, weight.....	400 lbs.
Foreign shipment, tight boxed (15 c. f.), weight.....	600 lbs.
Code word, as shown with tap holder.....	(Caniste
Code word of special tail block (extra).....	(Cank

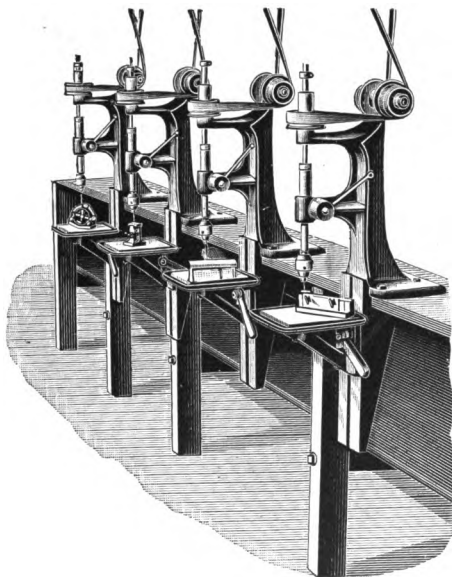


Specification of No. 3 Horizontal Tapping Machine.

This machine operates on the same general plan as the small horizontal tappers, but is geared up sufficiently to tap $\frac{3}{4}$ -inch holes. The work is held on the front or top surface of the slide, as most convenient, and pressed to the tap by the pilot wheel. When the adjustable stop on the slide strikes the tail block, the action of the tap draws the driving clutch out of gear, and a slight backward movement of the pilot wheel throws in the fast-running reversing clutch. The tap chuck is self-centering, two-jawed, one of special construction which grips the round shank and drives by the square end of the tap. The body of the chuck makes a universal joint with the end of the spindle to accommodate work out of center or taps not running true.

The tail block is adjustable along the bed and bound by the hand wheel. Chips and oil fall through the open bed to the large pan, and the oil drains into a reservoir, whence it is drawn off to supply an oil pot swung from the head stock.

Floor space required.....	41x22 in.
Greatest distance between chuck and work plate.....	9 in.
Swing over bed.....	11 $\frac{1}{2}$ in.
Width of spindle belt.....	2 $\frac{1}{4}$ in.
Tight and loose pulleys.....	8x3 in.
Speed of countershaft, revolutions per minute.....	350
Domestic shipment, crated, weight.....	700 lbs.
Foreign shipment, tight boxed (46 c. f.), weight.....	975 lbs
Code word, as shown, with chuck.....	(Cannibal)

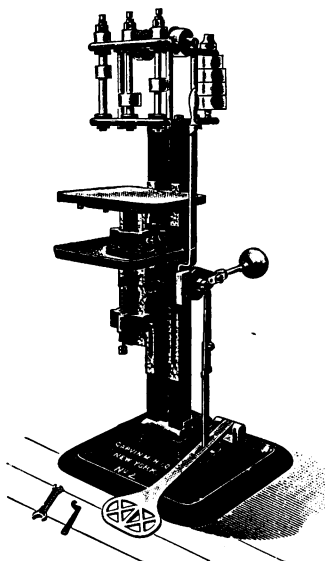


Specification of Bench Drill Press.

This style of drill is very sensitive, and occupies a small space; it is well adapted for jig drilling, for light manufacturing, and for this purpose may be grouped along a bench, as shown, making a very compact arrangement. When so used, they are driven by friction pulleys from one common countershaft. The spindle is counterbalanced by spring, and the driving pulley runs on a hollow stud, which relieves the spindle of the wear and pull of the belt. It has an adjustable stop on the upper end of spindle to regulate the depth of hole.

Space required for each.....	9x18 in.
Diameter of spindle.....	11-16 in.
Travel of spindle.....	3½ in.
Vertical adjustment of table.....	16½ in.
Size of table.....	9x9 in.
Maximum table distance from chuck.....	25 in.
Distance, spindle center to column face.....	5 in.
Width of spindle belt.....	1¼ in.
Tight and loose pulleys on countershaft.....	4½x2 in.
Speed of countershaft, revolutions per minute.....	320
Largest drill used.....	¾ in.
Net weight, complete, singly.....	150 lbs.
Foreign shipment, tight boxed (6 c. f.), weight.....	190 lbs.
Code word, including chuck and countershaft.....	(Cabinet)

Specification of No. 2 Gang Drill Press.



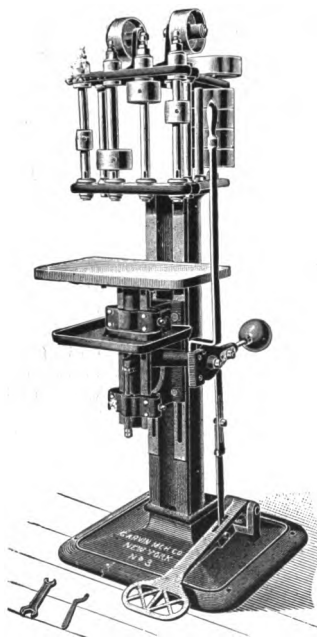
This machine is well adapted for the most accurate class of jig drilling, counterboring, facing, reaming, etc., the successive operations being done under the different spindles. The sliding bearings of the table are long and wide, and the table is nicely balanced by an adjustable weight. The knee is adjusted on the face of the column, and the lever and treadle can be set at any desired position. The spindles are 15-16 inch diameter, carefully hardened and ground and run in bronze boxes adjustable for wear. The thrust of the spindle is taken on a hardened step, and the lower bearing is protected by a collar. The drum shaft runs in hardened bearings, and is driven by an endless belt from the countershaft. The spindles run very light and at a high speed, and for drilling holes 1-16-inch to $\frac{3}{8}$ -inch diameter we believe it has no equal, and this criterion is based on the fact that we have a large number of these drills in use, and they give the best satisfaction.

The countershaft hangers are adjustable and self-olling.

We also build this press with one or two spindles. The single-spindle machine is provided with a three-step cone on the spindle, and is well adapted for general shop work, being quickly adjusted for a wide range of work.

The two-spindle press is fitted with a two-step cone on each spindle, and is well adapted for work where two operations can be performed at one handling.

Floor space required.....	36x29 in.
Center distance of spindles for 2 spindles.....	4 $\frac{1}{4}$ in.
Center distance of spindles for 3 spindles.....	4 $\frac{3}{4}$ in.
Minimum table distance from end of spindle.....	2 $\frac{3}{4}$ in.
Maximum table distance from end of spindle.....	18 in.
Size of table.....	18x12 in.
Distance, spindle center to column face.....	7 in.
Width of spindle belt.....	11 $\frac{1}{2}$ in.
Tight and loose pulleys on countershaft.....	6 and 8x2 $\frac{1}{2}$ in.
Speeds of countershaft, revolutions per minute.....	220 and 165
Domestic shipment, crated, weight.....	625 lbs.
Foreign shipment, tight boxed (47 c. f.), weight.....	1,000 lbs.
Code word of one-spindle press.....	(Cade)
Code word of two-spindle press.....	(Cadger)
Code word of three-spindle press.....	(Cactus)
Code word of four-spindle press.....	(Caddy)



Specification of No. 3 Gang Drill Press.

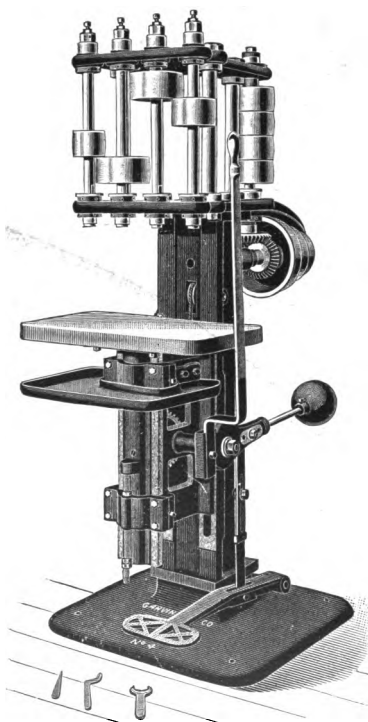
This machine is designed to take care of the most extensive class of manufacturing work where a large number of operations are required at one setting of the jig. It is built on broad lines throughout, and capable of drilling holes ranging from 1-16 to $\frac{1}{2}$ inch.

It runs noiselessly, and has no gearing except the rack and pinion for moving the table.

The spindle is 11-16-inch diameter, carefully hardened and ground, as are also the idler studs and drum bearings.

Floor space required.....	39x29 in.
Center distance of spindles.....	4 9-16 in.
Minimum table distance from end of spindle.....	4 in.
Maximum table distance from end of spindle.....	18 in.
Size of table.....	22x14 in.
Distance, spindle center to column face.....	7 in.
Width of spindle belt.....	21 $\frac{1}{4}$ in.
Tight and loose pulleys on countershaft.....	8 and 10x3 in.
Speed of countershaft, revolutions per minute.....	120 and 90
Domestic shipment, crated, weight.....	.875 lbs.
Foreign shipment, tight boxed (60 c. f.), weight.....	1.325 lbs.
Code word, as shown.....	(Cadet)
Code word of six-spindle press.....	(Cage)

Specification of No. 4 Gang Drill Press.



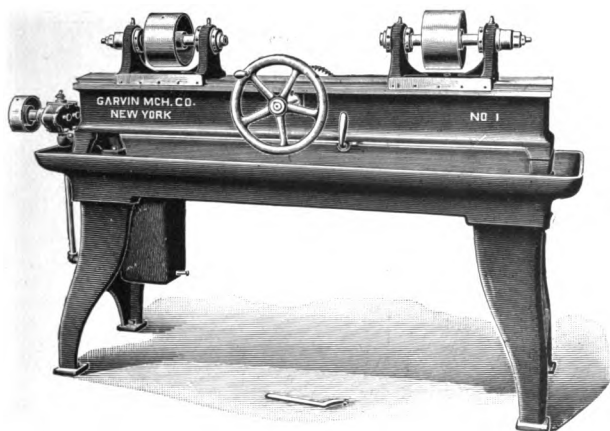
This is a heavy, substantial machine, designed for drilling holes ranging from $\frac{1}{4}$ to $\frac{7}{8}$ -inch diameter, for counterboring, reaming, facing, or any work that is convenient to be done on an upright drilling machine. The spindles are hardened and ground, and run in bronze boxes, adjustable for wear, and have taper holes $\frac{3}{4}$ inch in diameter, with drift slot for the reception of tools.

The thrust is taken on hardened steel steps on the top plate.

The table is fed by rack and pinion, fitted with adjustable hand and foot levers, and is provided with adjustable screw stops to regulate the depth of drilling.

The knee is adjustable on the column by worm gear and cable connection.

Floor space required.....	49x32 in.
Center distance of spindles.....	5 in.
Minimum table distance from end of spindle.....	6 in.
Maximum table distance from end of spindle.....	20 in.
Size of spindle.....	1 5-16x20 in.
Size of table.....	26x16 in.
Distance, spindle center to column face.....	7 $\frac{1}{8}$ in.
Width of spindle belt.....	2 $\frac{3}{4}$ in.
Tight and loose pulleys on countershaft.....	12x3 $\frac{1}{2}$ in.
Speed of countershaft, revolutions per minute.....	140
Domestic shipment, crated, weight.....	1,650 lbs.
Foreign shipment, tight boxed (89 c. f.), weight.....	2,050 lbs.
Code word, as shown.....	(Cajole)
Code word of six-spindle press.....	(Cake)

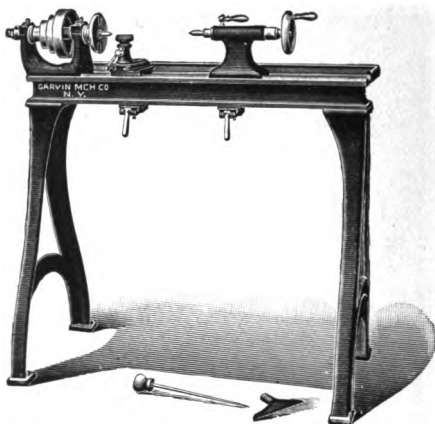


Specification of Duplex Drill Lathes.

(Made only to order.)

We make three sizes of these machines, which are especially adapted for manufacturing work requiring to be drilled, faced, etc., in line on opposite sides, or for greater speed in putting a hole clear through a piece, due to working from both ends at the same time. The work, such as a bicycle hub, sewing-machine arm, treadle, frame, etc., is held in a fixture and the spindles fed up simultaneously from each side, and the piece drilled with the certainty that the work will be in line and of uniform depth. The No. 3 machine is made only power feed, but the other sizes are made hand or power feed, as desired. Arrangement is made on the No. 3 size whereby one spindle stops feeding before the other, and a clear hole is completed by the second spindle, which pushes the first one back so that the drills do not collide. The oil pan is large and deep, and a pump can be provided and connected up to the drills with the flexible piping.

	No. 1	No. 2	No. 3
Swing over bed.....	9 $\frac{5}{8}$ in.	17 in.	8 in.
Maximum distance between heads.....	36 "	36 "	40 "
Largest drill used.....	$\frac{7}{8}$ "	1 $\frac{1}{4}$ "	2 "
Length of feed, each head.....	15 "	15 "	4 $\frac{1}{2}$ "
Width of spindle belt.....	4 "	4 "	3 $\frac{1}{2}$ "
Tight and loose pulleys on countershaft.....	12x3 "	14x4 "	14x4 "
Speed of countershaft, revolutions per minute	225	150	300
Floor space required.....	64x24 in.	64x24 in.	112x35 in.
Domestic shipment crated, weight.....	1,200 lbs.	1,300 lbs.	2,500 lbs.
Foreign shipment tight boxed, size.....	50 c. f.	50 c. f.	144 c. f.
Foreign shipment tight boxed, weight.....	1,500 lbs.	1,600 lbs.	3,250 lbs.
Code word.....	(Cambric)	(Camera)	(Camlet)
Code word of pump and piping, extra.....	(Calico)	(Camping)	(Cabinete)



10-INCH HAND LATHE (SCREW TAIL STOCK).

General Specification of Hand Lathes.

The hand lathe is a machine that needs no introduction, as it is indispensable in every shop. Being used constantly and abused more than any other tool, it is essential that its construction be on the most improved lines, and that it be made of the best material and workmanship.

Our lathes are designed for convenience and speed of manipulation, and will stand excessive use.

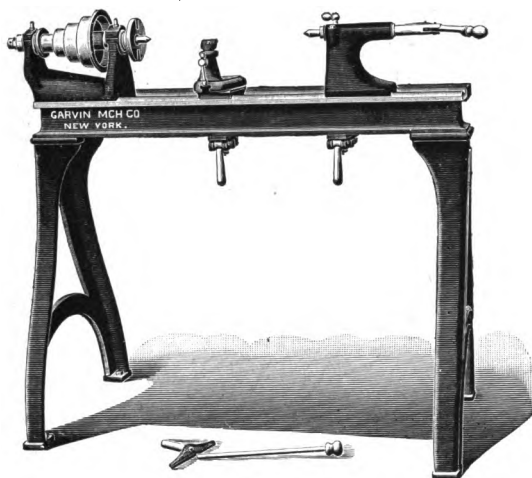
The spindles are hollow, being made of steel carefully hardened and ground, and run in the cap form of bronze boxes, having adjustments for wear, and so constructed as to always retain the spindle in the center position.

The cones are turned inside and out, insuring correct balance.

The head and tail stocks are substantially built, and the spindle of the latter is moved either by screw or lever, as desired.

A very convenient arrangement for the reception of tools and pieces of work is a wooden shelf supported by iron brackets, extending the full length of the bed at the back.

Countershaft hangers are adjustable and self-oiling.

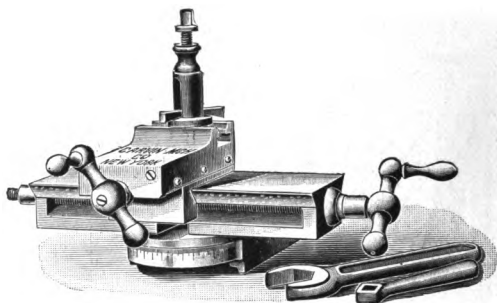


12-inch Hand Lathe (Fixed Lever Tail Stock).

Dimensions of Hand Lathes.

Nominal Swing of Lathe.....	10 in.	12 in	15 in.
Floor Space required.....	42x22 in.	50x24 in	62x30 in.
Length of bed.....	40 in	48 in	60 in.
Actual Swing of Lathe.....	11 in.	13 in.	15½ in.
Distance between centers.....	24 in.	26 in.	30 in.
Hole through spindle.....	¾ in	¾ in	1¼ in
Distance from floor to center of spindle.....	44 in.	45 in	42 in.
Width of spindle belt.....	1¼ in.	1½ in.	2¼ in.
Tight and loose pulleys on countershaft.....	6x2 in.	8x2½ in.	10x3 in.
Speed of countershaft, revolutions per minute.....	235	220	185
Domestic shipment, crated, weight.....	350 lbs.	470 lbs	675 lbs.
Foreign shipment, tight boxed, size.....	12 c. f.	24 c. f.	33 c. f
Foreign shipment, tight boxed, weight.....	475 lbs.	645 lbs	900 lbs.
Code Word—with screw tail stock.....	(Captor)	(Casket)	(Carbine)
Code Word—with lever tail stock.....	(Canton)	(Canter)	(Canopy)

For slide rest, see page 142



Specification of Slide Rests.

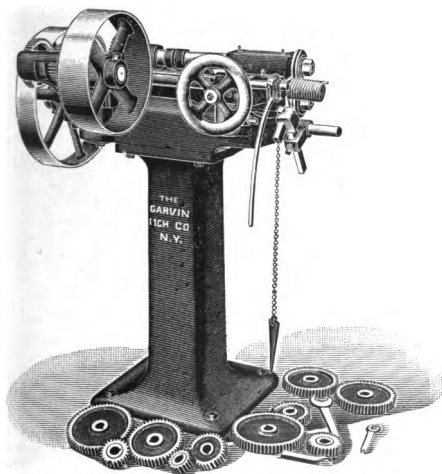
This is a very convenient tool for rapid work, being made with accurate steel screws and carefully scraped bearings.

The tool post is quickly adjusted for height of tool and the base is graduated to facilitate setting for turning tapers.

	10 in. lathe.	12 in. lathe	15 in. lathe.
Longitudinal feed.....	$7\frac{5}{16}$ in.	$7\frac{1}{4}$ in.	$6\frac{1}{4}$ in.
Cross feed.....	$2\frac{1}{8}$ in.	$2\frac{7}{8}$ in.	$6\frac{1}{2}$ in.
Size of tool used.....	$\frac{1}{4} \times \frac{5}{8}$ in.	$\frac{3}{8} \times \frac{3}{4}$ in.	$\frac{5}{8} \times 1\frac{1}{4}$ in.
Code Word, as shown.....	(Cart)	(Case)	(Caul)

For Hand Lathes, see pages 140 and 141.

Specification of Spring Coiling Machines.



The cut illustrates our machine for bending wire into a continuous open or closed coil or spring.

The wire passes through an adjustable guide, and then (according as the spring is to be wound right or left) under or over the arbor on which it is to be wound.

It is held to the arbor by two grooved rolls, both arbor and rolls being driven by power.

One arbor, one pair of rolls, and set of change gears, accompany a complete machine.

In the illustration, the wire is shown feeding in from the left, and issuing in a coil at the right. The spring should run off in a trough 25 or 30

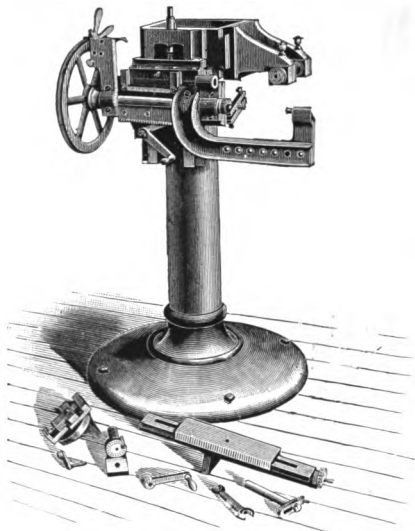
feet long to a power or foot press, where it is cut into the desired lengths, and the ends of tension springs looped by special fixtures carried in the press.

When ordered, we can furnish the cutting-off and looping fixtures at prices named below.

Sample of spring or wire should always be submitted, that we may recommend the proper machine for the work.

Dimensions of Spring Coilers.

Number of machine.....	1	2	3	4
Code word.....	Hackle	Haggie	Halcyon	Halibut
Largest diameter of spring.....	1½ in.	3 in.	4 in.	4 in.
Largest wire will use. Gauge.....	No. 12	No. 6	No. 4	½ in.
Smallest diameter of spring.....	¼ in.	¾ in.	¾ in.	2½ in.
Smallest wire will use. Gauge.....	No. 22	No. 14	No. 12	⅜ in.
Width of spindle belt.....	2 in.	2¾ in.	2¾ in.	2¾ in.
Tight and loose pulleys.....	8x2½ in.	10x3 in.	12x3 in.	8x3 in.
Speed of countershaft. revolutions per minute.	300	200	300	400
Domestic shipment, crated, weight.....	450 lbs.	510 lbs.	775 lbs.	1,275 lbs.
Foreign shipment, tight boxed, size.....	27 c. f.	27 c. f.	38 c. f.	50 c. f.
Foreign shipment, tight boxed, weight.	535 lbs.	600 lbs.	900 lbs.	1,500 lbs.
Extra sets of rollers, per pair.....(Hallow)				
Extra arbors, each.....(Halter)				
Die for cutting off spring.....(Hamlet)				
Die for looping spring.....(Hamper)				



Specification of No. 1 Gear Cutter.

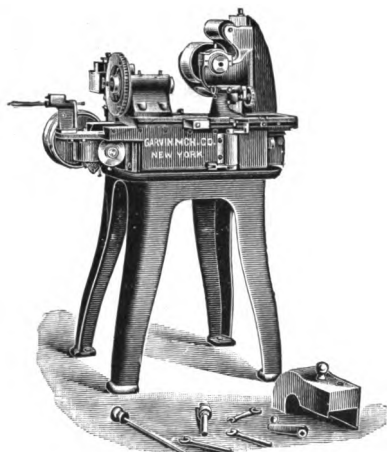
This handy little machine is intended for rapid and convenient cutting of light gears, ratchets, etc., used in telegraphic and mathematical instruments, etc. It will swing a diameter of 6 inches on centers and about 12 inches when the arm which carries the tall center is taken off. The slide has a movement of $5\frac{1}{4}$ inches between two adjustable stops. The cutter head also has a lateral adjustment of 3 inches, and is provided with stops allowing the use of a roughing and finishing cutter side by side on the arbor, one stop determining the position of the roughing cutter and the other that of the finishing cutter.

The slide has ample vertical adjustment for the varying sizes of work and depths of cut. A backing-up support for the work is furnished, which prevents chattering and secures smooth cuts in thin, flexible gears.

The indexing is done by means of a pawl moving between two adjustable stops and acting on a large ratchet wheel.

We can also furnish a rack-cutting attachment, with micrometer adjustments in thousandths of an inch, a bevel gear fixture with necessary adjustments for cutting the gear to a center, and a small swivel vise. (These are shown in the cut.)

Floor space required.....	24x24 in.
Width of spindle belt.....	2 in.
Tight and loose pulleys on countershaft.....	4½x2 in.
Speed of countershaft, revolutions per minute.....	400
Domestic shipment, crated, weight.....	500 lbs.
Foreign shipment, tight boxed (20 c. f.), weight.....	575 lbs.
Code word of machine.....	(Handbill)
Code word, extra for swivel vise.....	(Hang)
Code word, extra for rack-cutting attachment.....	(Hard)
Code word, extra for bevel-gear attachment.....	(Hash)



Specification of No. 2 Automatic Gear Cutter.

The movements of the machine are entirely automatic, being provided with a trip to stop when work is finished. It will cut gears from 8-inch diameter and 8-inch face down to the smallest, and, with the proper index, from 10 to 200 teeth. The index ring is of large diameter, and is solidly locked at each indexing, insuring accuracy and good work. The cutter head is adjustable to thousandths, and the cutter can be quickly centered by means of a screw collar on the arbor. The slide runs back and comes forward again to the cut at a speed 65 times faster than the cutting feed. This is an important point, and reduces the time lost in indexing to a minimum. The travel of the table is regulated by adjustable stops in front, and the machine can be set to work anywhere in the length of the work arbor, avoiding all unnecessary travel. The setting up is done very quickly, so that the machine can be practically used in jobbing work as well as in special manufacturing.

The bed of the machine sets in an oil pan with extension to catch the drips of the slide, and is provided with an oil reservoir to which a pump can be attached. We build a larger size of this machine of the same general design, but adapted to a larger and heavier class of work.

Floor space required.....	39x21 in.
Width of spindle belt.....	2 in.
Tight and loose pulleys on countershaft.....	8x2½ in.
Speed of countershaft, revolutions per minute.....	120
Domestic shipment, crated, weight.....	725 lbs.
Foreign shipment, tight boxed (43 c. f.), weight.....	850 lbs.
Code word, as shown.....	(Handcuff)

**Table of Diametral Pitch, with its Equivalent Circular.
Pitch Opposite on the Adjoining Column.**

Diametral Pitch.	Circular Pitch.	Diametral Pitch.	Circular Pitch.	Circular Pitch.	Diametral Pitch.	Circular Pitch.	Diametral Pitch.
2	1.57	11	.280	1 3-4 in.	1.79	3-4 in.	4.19
2 1-4	1.39	12	.262	1 1-2 "	2.09	11-16 "	4.57
2 1-2	1.25	14	.224	1 7-16 "	2.18	5-8 "	5.03
2 3-4	1.14	16	.116	1 3-8 "	2.28	9-16 "	5.58
3	1.05	18	.174	1 5-16 "	2.39	1-2 "	6.28
3 1-2	.898	20	.157	1 1-4 "	2.51	7-16 "	7.18
4	.785	22	.143	1 3-16 "	2.65	3-8 "	8.38
5	.628	24	.130	1 1-8 "	2.79	5-16 "	10.06
6	.524	26	.120	1 1-16 "	2.96	1-4 "	12.56
7	.448	28	.112	1	3.14	3-16 "	16.75
8	.392	30	.104	15-16 "	3.35	1-8 "	25.12
9	.350	32	.098	7-8 "	3.59	1-16 "	50.24
10	.314			13-16 "	3.86		

Simple Rules on Gearing.

The following rules will apply to both Bevel and Spur Gears. When the term "pitch" is used, it always signifies diametrical (not circular) pitch. For illustrations we will use gears having 64 teeth and 8 pitch.

To find Pitch Diameter.—Divide the number of teeth by the pitch: $64 \div 8 = 8$ in. p. diam.

To find Number of Teeth.—Multiply the pitch diam. by the pitch: $8 \text{ in.} \times 8 = 64$, No. of teeth.

To find the Pitch.—Divide the number of teeth by the pitch diam.: $64 \div 8 \text{ in.} = 8$, pitch.

To find Outside Diameter of Spur Wheels.—Add 2 to the number of teeth and divide by the pitch: $64 + 2 = 66 \div 8 = 8\frac{1}{4}$ in., O. D.

To find Circular Pitch.—Divide the decimal 3.1416 by the diametrical pitch: $3.1416 \div 8 = .3927$ in.

To find the Distance between the Centers of Two Spur Gears.—Divide half the sum of the teeth of both gears by the pitch: $64 + 64 = 128 \div 2 = 64 \div 8 = 8$ in. centers.

A simple rule to determine the face of bevel gears is to make them seven times the pitch: 8 pitch bevel will thus be $\frac{7}{8}$ in. face.

Twist Drill and Steel Wire Gauge.

Table of Sizes of Gauge in Decimal Parts of an inch.

No.	Size of Number in Decimals.	No.	Size of Number in Decimals.	No.	Size of Number in Decimals.	No.	Size of Number in Decimals.
1	.228	16	.177	31	.150	46	.081
2	.221	17	.173	32	.116	47	.0785
3	.213	18	.1695	33	.113	48	.076
4	.209	19	.166	34	.111	49	.073
5	.2055	20	.161	35	.110	50	.070
6	.204	21	.159	36	.1065	51	.067
7	.201	22	.157	37	.104	52	.0635
8	.199	23	.154	38	.1015	53	.0595
9	.196	24	.152	39	.0995	54	.055
10	.1935	25	.1495	40	.098	55	.052
11	.191	26	.147	41	.096	56	.0465
12	.189	27	.144	42	.0935	57	.043
13	.185	28	.1405	43	.089	58	.042
14	.182	29	.136	44	.086	59	.041
15	.180	30	.1285	45	.082	60	.040

Table of Decimals Equaling Parts of an Inch.

1-64.....	.0156	33-64.....	.5156
1-32.....	.0313	17-32.....	.5313
3-64.....	.0469	35-64.....	.5469
1-16.....	.0625	9-16.....	.5625
5-64.....	.0781	37-64.....	.5781
3-32.....	.0938	19-32.....	.5938
7-64.....	.1094	39-64.....	.6094
1-8.....	.1250	5-8.....	.6250
9-64.....	.1406	41-64.....	.6406
5-32.....	.1563	21-32.....	.6563
11-64.....	.1719	43-64.....	.6719
3-16.....	.1875	11-16.....	.6875
13-64.....	.2031	45-64.....	.7031
7-32.....	.2188	23-32.....	.7188
15-64.....	.2344	47-64.....	.7344
1-4.....	.2500	3-4.....	.7500
17-64.....	.2656	49-64.....	.7656
9-32.....	.2813	25-32.....	.7813
19-64.....	.2969	51-64.....	.7969
5-16.....	.3125	13-16.....	.8125
21-64.....	.3281	53-64.....	.8281
11-32.....	.3438	27-32.....	.8438
23-64.....	.3594	55-64.....	.8594
3-8.....	.3750	7-8.....	.8750
25-64.....	.3906	57-64.....	.8906
13-32.....	.4063	29-32.....	.9063
27-64.....	.4219	59-64.....	.9219
7-16.....	.4375	15-16.....	.9375
29-64.....	.4531	61-64.....	.9531
15-32.....	.4688	31-32.....	.9688
31-64.....	.4844	63-64.....	.9844
1-2.....	.5000	1.....	1.

Table of Wire Gauge Sizes in Decimal Parts of an Inch.

No. of Wire Gauge	Size of each No. in decimal parts of an inch of the American Wire Gauge.	Size of each No in decimal parts of an inch of the English Wire Gauge.	No. of Wire Gauge.	Size of each No in decimal parts of an inch of the American Wire Gauge.	Size of each No. in decimal parts of an inch of the English Wire Gauge
0000	.460	.454	19	.03539	.042
000	.40964	.425	20	.03196	.035
00	.36480	.380	21	.02846	.032
0	.32495	.340	22	.02535	.028
1	.28930	.300	23	.02257	.025
2	.25763	.264	24	.0201	.022
3	.22942	.239	25	.0179	.020
4	.20431	.208	26	.01594	.018
5	.18194	.182	27	.01419	.016
6	.16202	.163	28	.01264	.014
7	.14428	.148	29	.01126	.013
8	.12849	.135	30	.01002	.012
9	.11443	.118	31	.00893	.010
10	.10189	.104	32	.00795	.009
11	.09074	.092	33	.00708	.008
12	.08081	.081	34	.0063	.007
13	.07196	.072	35	.00561	.005
14	.06408	.063	36	.005	.004
15	.05707	.052	37	.00445	....
16	.05082	.045	38	.00396	....
17	.04525	.042	39	.00353	....
18	.0403	.039	40	.00314	....

Weight of Round Steel Per Lineal Foot.

For Wrought Iron Multiply Tabular Weights by .993.

Diameter in Inches.	Weight Per Foot.	Diameter in Inches.	Weight Per Foot.	Diameter in Inches.	Weight per Foot
1-16	.0104	1 1-16	3.011	2 -8	12.044
1-8	.042	1 1-8	3.375	2 1-4	13.503
3-16	.094	1 3-16	3.761	2 3-8	15.045
1-4	.167	1 1-4	4.168	2 1-2	16.67
5-16	.261	1 5-16	4.595	2 5-8	18.379
3-8	.375	1 3-8	5.043	2 3-4	20.171
7-16	.511	1 7-16	5.512	2 7-8	22.047
1-2	.667	1 1-2	6.001	3	24.005
9-16	.844	1 9-16	6.512	3 1-8	26.048
5-8	1.042	1 5-8	7.043	3 1-4	28.173
11-16	1.261	1 11-16	7.596	3 3-8	30.382
3-4	1.5	1 3-4	8.169	3 1-2	32.674
13-16	1.761	1 13-16	8.702	3 5-8	35.05
7-8	2.042	1 7-8	9.377	3 3-4	37.508
15-16	2.344	1 15-16	10.013	3 7-8	40.05
1	2.667	2	10.669	4	42.675

Sizes of Standard Hexagon Head Bolts.

Dia. of Bolt.	Thi'kn's of H'd	Size of Hex'g'n.	Across Corners.	Thd's per inch.
1-4 inch	1-4 inch	1-2 inch	9-16 inch	20
5-16 "	19-64 "	19-32 "	11-16 "	18
3-8 "	12-32 "	11-16 "	25-32 "	16
7-16 "	25-64 "	25-32 "	29-32 "	14
1-2 "	7-16 "	7-8 "	1 " "	13
9-16 "	31-64 "	31-32 "	1 7-64 "	12
5-8 "	17-32 "	1 1-16 "	1 7-32 "	11
3-4 "	5-8 "	1 1-4 "	1 7-16 "	10
7-8 "	23-32 "	1 7-16 "	1 21-32 "	9
1 "	13-16 "	1 5-8 "	1 7-8 "	8
1 1-8 "	29-32 "	1 13-16 "	2 3-32 "	7
1 1-4 "	1 " "	2 " "	2 5-16 "	7
1 3-8 "	1 3-32 "	2 3-16 "	2 1-2 "	6
1 1-2 "	1 3-15 "	2 3-8 "	2 3-4 "	6
1 5-8 "	1 9-32 "	2 9-16 "	2 15-16 "	5 1-2
1 3-4 "	1 3-8 "	2 3-4 "	3 3-16 "	5
1 7-8 "	1 15-32 "	2 15-16 "	3 13-32 "	5
2 "	1 9-16 "	3 1-8 "	3 5-8 "	4 1-2
2 1-4 "	1 3-4 "	3 1-2 "	4 1-16 "	4 1-2
2 1-2 "	1 15-16 "	3 7-8 "	4 1-2 "	4
2 3-4 "	2 1-8 "	4 1-4 "	4 29-32 "	4
3 "	2 5-16 "	4 5-8 "	5 3-8 "	3 1-2

Notice that size of Hexagon is equal to diameter of bolt + $\frac{1}{2}$ diameter of bolt + $\frac{1}{8}$ of an inch, and also that thickness of head is $\frac{1}{2}$ of hexagon in every case. The thickness of nut is equal to the diameter of bolt.

Calculating Speed of Pulleys.

Example.—A main shaft running 110 rev. and a 12-inch hand lathe countershaft with 8-inch tight and loose pulleys running 220 rev. (See page 141.)

To find Size of Pulley on Main Shaft.—Multiply diameter of pulley on countershaft by its number of revolutions, and divide the product by number of revolutions of main shaft. The quotient will be its diameter: $8 \times 220 = 1760$, $1760 \div 110 = 16$ inches diameter.

To find No. of Revolutions of Countershaft.—Multiply diameter of pulley on main shaft by its number of revolutions, and divide product by diameter of pulley on countershaft: $16 \times 110 = 1760$, $1760 \div 8 = 220$ rev.

To find Size of Pulley on Countershaft.—Multiply diameter of pulley on main shaft by its number of revolutions, and divide product by number of revolutions of countershaft: $16 \times 110 = 1760$, $1760 \div 220 = 8$ inches diameter.

Miscellaneous Weights.

	Average Weight, Cubic Ft.	Average Weight, Cubic In.
Cast Iron	450 pounds.	.260 pounds.
Wrought Iron	485 "	.281 "
Gun Metal	528 "	.306 "
White Pine	25 "	.015 "
Steel	489 "	.283 "

Cast iron is $17\frac{1}{2}$ times heavier than ordinary kiln-dried wood used in common patterns.

TELEGRAPHIC CODE.

CABLE ADDRESS: { "NEEDFUL," NEW YORK.
"IMPETUS," BERLIN.

Lieber's and A. B. C. codes used when required.

- Dash**.....Enter our order for, will send shipping instructions by mail.
- Dazzling**....How soon can you ship?
- Deacon**.....When will you ship?
- Deadly**.....Can you ship immediately?
- Decade**.....Ship immediately.
- Deceit**.....Ship as soon as possible.
- Declare**.....Ship via—
- Define**.....Send tracer after—
- Defraud**.....Telegraph very quickest possible delivery of—
- Degree**.....If size wanted is not in stock, then how soon can you furnish it?
- Delight**.....What is the nearest size in stock?
- Demolish**....Name the lowest rate you can get by carload to—
- Diploma**....Can positively secure order if you can deliver in—
- Disable**.....Order depends upon prompt delivery.
- Dodger**.....Ship in carload with—
- Dogma**.....Prepare for immediate shipment. Have order for—
- Domain**.....Have secured order for—
- Dream**.....We are figuring with—
- Dregs**.....Apply to Deutsche Garvin-Maschinen-Fabrik A. G., 17 Burg Strasse, Berlin, C., Germany.
- Drift**.....Apply to our agents, Messrs. C. W. Burton, Griffiths & Co., Ludgate House, 23a, Ludgate Hill, London.
- Estate**.....We have in stock and can ship immediately.
- Excuse**.....We can ship in about three days.
- Exhaust**....We can ship in about five days.
- Expand**.....We can ship in about one week.
- Extract**.....We can ship in about ten days.
- Fable**.....We can ship in about two weeks.
- Factor**.....We can ship in about three weeks.
- Faculty**.....We can ship in about thirty days.
- Failing**.....We can ship in about five weeks.
- Faithful**....We can ship in about six weeks.
- Falsify**.....We can ship in about sixty days.
- Familiar**....We can ship in about ninety days.
- Fashion**.....We can ship positively in—
- Father**.....We may be able to ship sooner, but can not promise it.
- Fatigue**.....Time of delivery named is very best we can do.
- Favor**.....We can not possibly ship sooner than—
- Fearless**....Will ship no later than—

- Fellow**.....Have one in stock now; could not furnish duplicate until—
- Felony**.....One almost finished, still unsold; not furnish another until—
- Female**....Your order was shipped on—
- Fence**.....We expect to ship in—
- Ferment**...We have sent tracer after—
- Festival**....We will ship immediately.
- Fiddle**.....Nothing of approximate size in stock.
- Filter**.....We have a second-hand machine of following size—
- Finance**....Forward shipping directions for—
- Fishing**....Weight will be about — pounds.
- Fleet**.....Will send particulars by mail.
- Flirt**.....If you can not give the desired information immediately, then answer how soon we may expect same.
- Flower**....Please refer to our letter dated—
- Fodder**.....Please refer to our telegram dated—
- Foliage**....See our descriptive circular for the desired information.
- Foolish**....For the desired information, see our catalogue, page—
- Forbid**.....Mail particulars regarding—
- Forehead**...We do not understand what you mean by—
- Formal**... Please note particularly that—
- Fossil**.....Have not yet received formal order for—
- Founder**... Shall we go ahead with your order?
- Fraction**...We are ready to ship—
- Fraud**.....Shall we ship alone, or hold for shipment together with—
- Frigate**....They will not be ready to ship until—
- Frog**.....Our shipment is less than carload. Have you anything to fill car?
- Furnace**....We have only quoted regular prices.
- Gender**....These prices are subject to a discount of — per cent.
- General**....These prices are subject to your regular discount.
- German**....These prices are net cost to you.
- Ghost**.....Regular price is the best we can do.
- Giant**.....We are unable to modify our quotation.
- Gigantic**...To enable you to secure order, will make following special price—
- Gimlet**.....We will make you the following special terms—
- Ginger**.....We will deduct—
- Girl**.....If the following is not wanted—
- Glade**.....Arrange payment upon presentation of Bills Lading in New York.
- Glair**.....We have arranged for payment upon presentation of Bills Lading in New York.
- Gland**.....Our terms are cash upon presentation Bills Lading New York.

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